JANUARY, 1957

METAL FINISHING

DEVOTED EXCLUSIVELY TO METALLIC SURFACE TREATMENTS

FOUNDED 1903

CLEPO METAL FINISHING CLEANERS AND PROCESSES

3 CLEPO COMPOUNDS

For Better Bright Burnishing

161-P for brass, aluminum, copper, steel, etc.

164-Z for zinc-base die castings

202 SPECIAL recently developed purposely . . .

. . . to produce high luster on brass parts; also suitable for all other metals except zinc or lead base castings.

These CLEPO Compounds account for three of our extensive lines of burnishing compounds, each being formulated to give best specified results on certain metals only. No single compound can do an A-1 job on all metals and produce any finish desired. CLEPO 202 Special, for example, was formulated to produce highest luster but at the same time eliminate the danger of tarnish stains on either the work or steel balls should the load be left in the barrel for any length of time. Other compounds, not being so inhibited, can cause such stains.

We suggest that if you are doing *any* barrel burnishing, you ask our Field Service Man to check your production methods and materials. Backed by many years of experience in this very line of work, perhaps he can be of help.

FREDERICK GUMM *Chemical Company Inc.*

538 FOREST STREET, KEARNY, N. J.

2/Circle on Readers' Service Card

ENTHONE Emulsion Cleaner 75

Removes Oil and Solid Dirt in SECONDS!

SIMPLE OPERATION . . . MANY ADVANTAGES

DIP . . . steel parts to be cleaned in Emulsion Cleaner 75 for only *15 seconds.* This simple immersion is done at room temperature (no heating facilities required) and with no irritation of the operator's nose, throat or skin.

RINSE . . . in plain water.

DONE . . . and done *thoroughly* . . . in seconds! All heavy oil films and solid dirt have been removed from every corner and crevice . . . from slots, tapped holes and sculptured patterns.

INSURE . . . smoother, brighter, more adherent electrodeposits . . . and a reduction in pitting.

WRITE FOR FREE LITERATURE ON THIS SIMPLE, FAST, SAFE . . . AND ECONOMICAL . . . METHOD OF CLEANING METALS.

Service Representatives and Stock Points in Principal Cities of U.S.A. and Canada, Brazil, England, France, Sweden, and Germany

ENTHONE INCORPORATED

442 ELM STREET, NEW HAVEN 11, CONNECTICUT

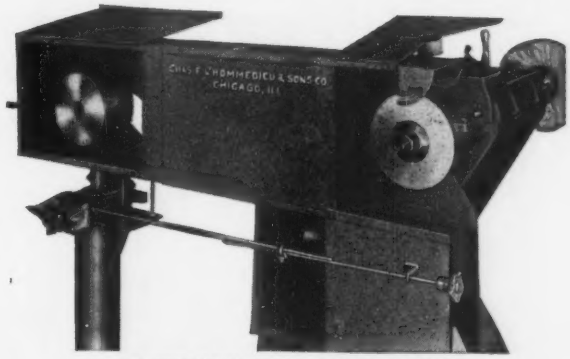
Metal Finishing Processes • Electroplating Chemicals

Metal Finishing is published monthly by the Finishing Publications, Inc., 381 Broadway, Westwood, New Jersey, U.S.A.
Entered as second class matter at the Post Office in Westwood, N. J. Volume 55, No. 1, January, 1957. Four Dollars Per Year.

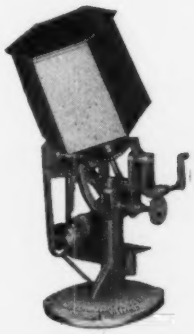
USE "RELIANCE" PRODUCTS FOR

ECONOMY : EFFICIENCY : DEPENDABILITY

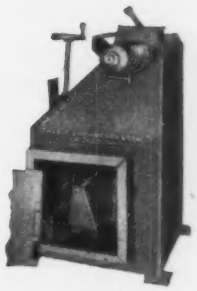
WRITE FOR FURTHER DETAILS



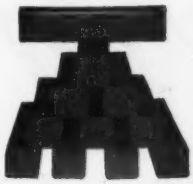
BACKSTAND IDLER WITH LATHE



OBLIQUE
TUMBLING BARREL



#23A
POLISHING LATHE



EXTRUDED COMPOSITIONS
STANDARD SIZE
2 x 2 x 10"

NUWAY BUFFS FOR
FAST CUTTING

BACKSTAND IDLER

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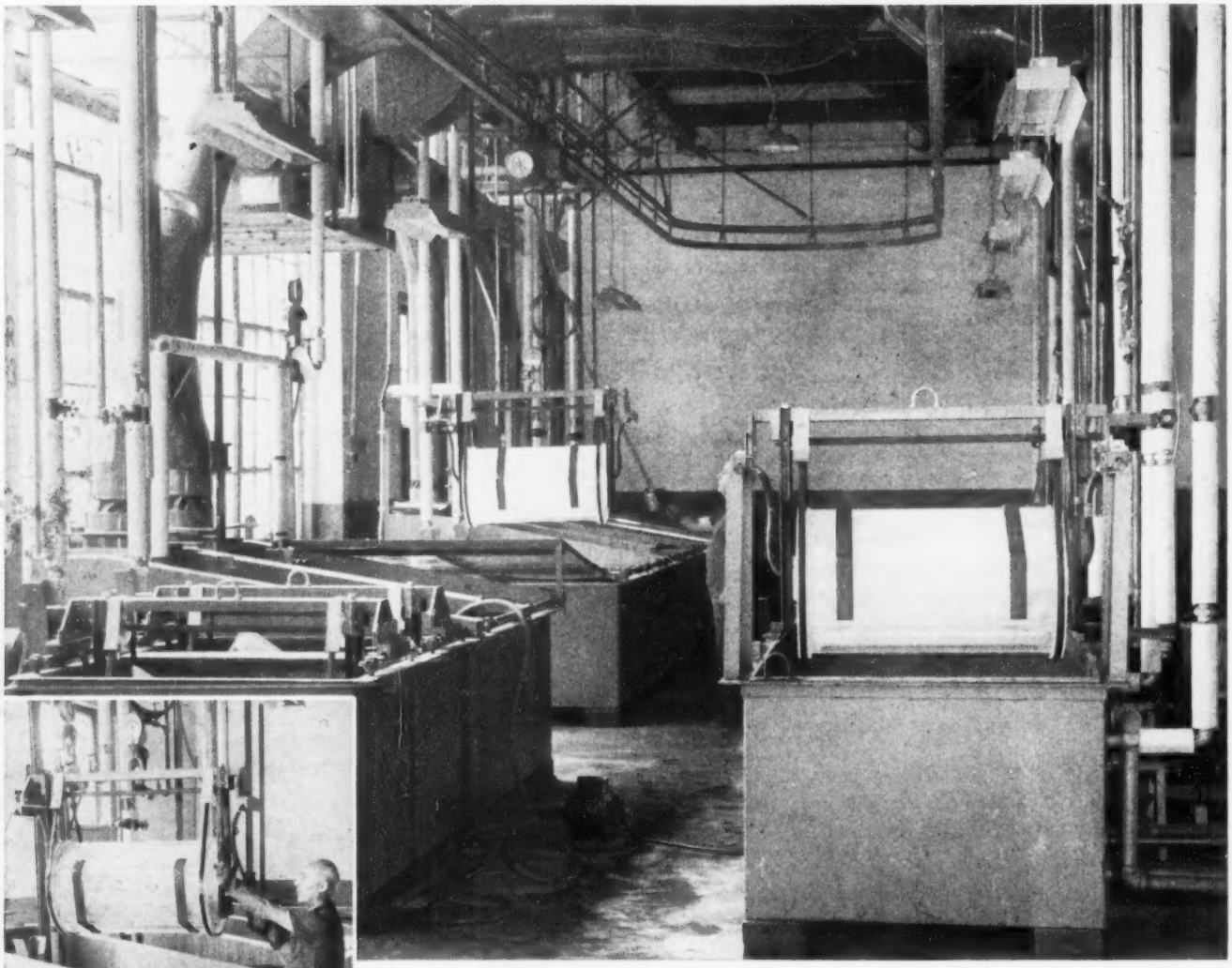
Electric Auto-Lite adds More Proof...



that G-S means Greater Savings!

New G-S Belt Drive Barrel Installation Streamlines Syracuse Division of The Electric Auto-Lite Company

A smoother operation was the immediate result of putting in the complete "through-cycle" line of G-S Belt-Drive Plating Barrels with Loader, Unloader and Driers in the Syracuse Division of The Electric Auto-Lite Company. Plating is faster and better quality.

Electric Auto-Lite typical of all G-S installations!

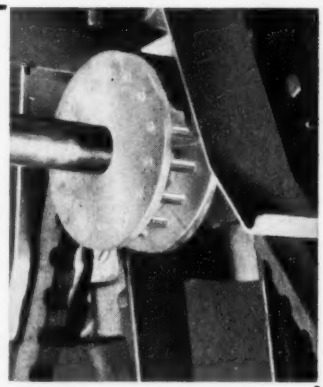
New G-S "Cogged-V-Belt" Drive Plating Barrels outperform them all. Larger loads, faster, better plating at higher current densities. "Through-cycle" service and longer trouble-free equipment life with no down-time. Exclusive "Cogged-V-Belts" and cogged drive pulleys constant meshed for positive power transmission without gears. Cogged-V-Belts steel tensile members won't stretch. "Locking-U-Hubs" — danglers angled down through hubs won't "ride" up on load. Quick, easy changing of cylinder and danglers saves hours. Adjustable Bearings, Floating End Plates for constant contact. Total Cylinder immersion prevents explosions. Cylinders of H-T Sincolite or Tempron (hard rubber) fusion-welded, heavy-ribbed construction. **G-S equipped platers get bigger returns per investment.** Check into the G-S Conversion Plan. It costs less than you think and pays for itself in savings.

SAVE 100%

gear maintenance

Elim: cyl. end drive gear, idler gear, pinion gear, 3 bearings. No gears or bearings in solution.

Exclusive G-S—"The Belt-Drive with the Gear-Grip." See more features for better, faster plating at lower cost than ever before offered. Send for Bulletin GSB-101.



The G-S Equipment Co.

15585 Brookpark Road **Cleveland 11, Ohio**

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STEVENS MONEY-SAVING 72 HOUR SLAKE TEST

STEVENS MONEY-SAVING 72 HOUR SLAKE TEST

Order Your Test Sample Today

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L.V.* SLO-SLAKE LIME BUFFING COMPOSITION

OFFERS

1. Savings in compound since less composition will be discarded as a result of slake waste.
2. Extremely long storage life enables purchase of quanity shipments with important savings.
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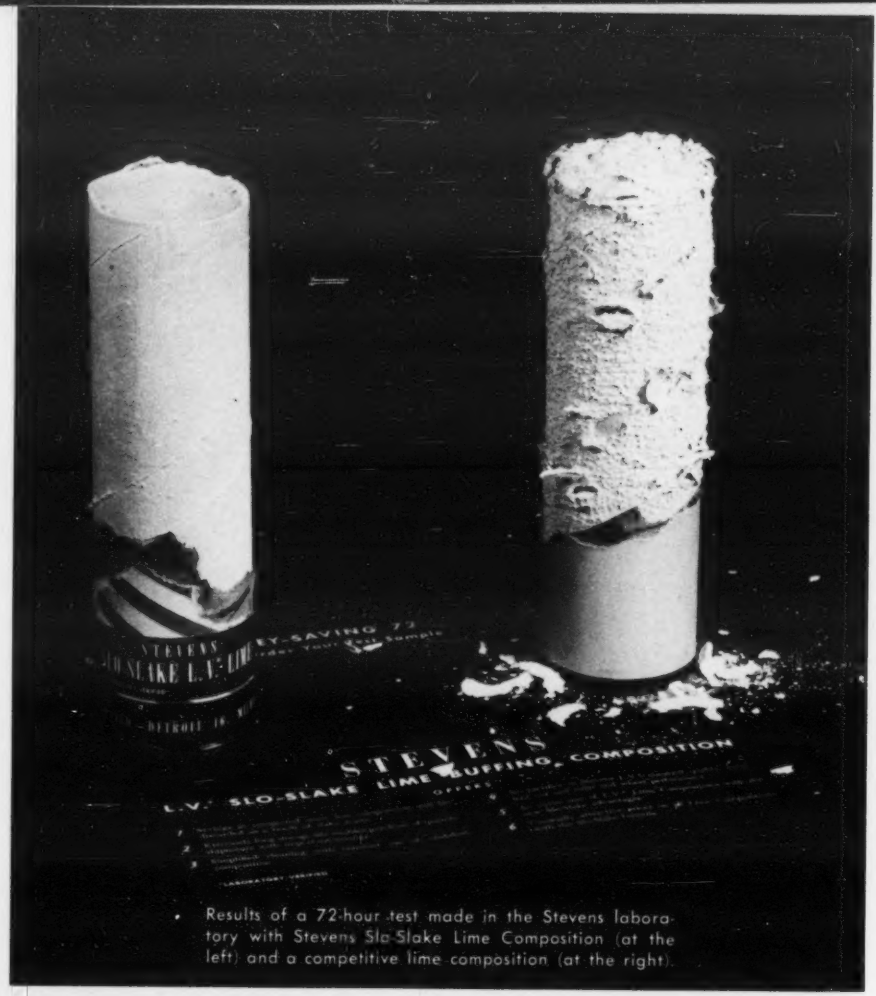
5. An entire line of L.V.* Lime Compositions with the new Slo-Slake advantages.
6. Unusually attractive prices on all Lime Compositions with the Slo-Slake formula.

LABORATORY VERIFIED



Results of a 72-hour test made in the Stevens laboratory with Stevens Slo-Slake Lime Composition (at the left) and a competitive lime composition (at the right).

MAKE THIS TEST OF STEVENS SLO-SLAKE LIME BUFFING COMPOSITION

1. Get a sample of Stevens Slo-Slake Lime Composition from the Stevens representative or write directly for sample to Frederic B. Stevens, Inc., 1800 – 18th Street, Detroit 16, Michigan.
2. Get a sample of lime composition you are now using.
3. Tear off the cardboard from each container.
4. Place tubes on opposite side of this card in circles indicated and let stand for 72 hours.
5. Results will be similar to the above photograph.

STEVENS L.V.*

POLISHING AND BUFFING COMPOSITIONS

Frederic B. Stevens, Inc. manufactures a wide variety of products used in the finishing of plated parts. These items range from the softest dry rouge for coloring thin gold "flash" plate to a wet lime composition for automatic buffing of nickel-plated automobile bumpers.

For a complete list of Stevens polishing and buffing compositions write for Stevens Catalog Number 51 which also gives helpful hints on buff speeds, cake sizes and type of compositions to use on different materials.

Two new Technical Bulletins are now available. No. P-124 "Successful Stevens L.V.* Finishing of Stainless Steel" and No. P-125 "Successful Stevens L.V.* Finishing of Zinc and Aluminum Base Die Castings." Write for your copies today. *Frederic B. Stevens, Inc., 1802 – 18th Street, Detroit 16, Michigan.*

**Laboratory Verified.*

CUSTOMER SERVICE LABORATORY

Stevens complete metal finishing laboratory facilities are at *your* disposal. The service is *free.*

If you have a new product requiring a final finish, send samples and a letter outlining your requirements. We will furnish you with a formal Stevens L.V.* report showing the final results. We will also include recommendations as to type of equipment, procedure and the liquid or dry compositions to use.

Also we can check your present operations and advise you of recommended cost cutting improvements in your equipment and sequence of operations—the type of belts, wheels, buffs and the Stevens compositions Laboratory Verified for your job. Write us today.

STEVENS 75 YEARS OF SERVICE

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YOUR METAL FINISHING SUPERMARKET
DETROIT 16, MICHIGAN

year after year, you get

BALANCED QUALITY*

in

MICCROSOL

Developed originally as a coating for plating racks, Miccrosol E-1003 has all the desirable characteristics which make it an ideal coating for many other applications.

The chemical resistance of Miccrosol is unequalled in its field. Its toughness, abrasion resistance, resilience, and flexibility are unsurpassed. It's easy to apply in either a *dip* or *spray* formula. When necessary, it's easy to repair.

Year after year we build this quality into Miccrosol, improving it whenever possible and practicing every economy in its manufacture that does not compromise the excellence of the product.

This BALANCED QUALITY enables you to use Miccrosol *profitably* while assuring your customers of coating jobs that will prove superior in their performance.

**Outstanding performance and value*

The above illustrations show Miccrosol being used as a coating: At the left, Miccrosol Spray S-2003 is being applied to a large plating tank. At the right, Miccrosol E-1003 has been applied by dipping this large paddle. Contact us for the name of the qualified Miccrosol coater nearest you.

Miccrol Products

Developed and manufactured by experienced platers and coaters

It's Tops!

For tanks, ducts, and other equipment

MICHIGAN CHROME *and Chemical Company*

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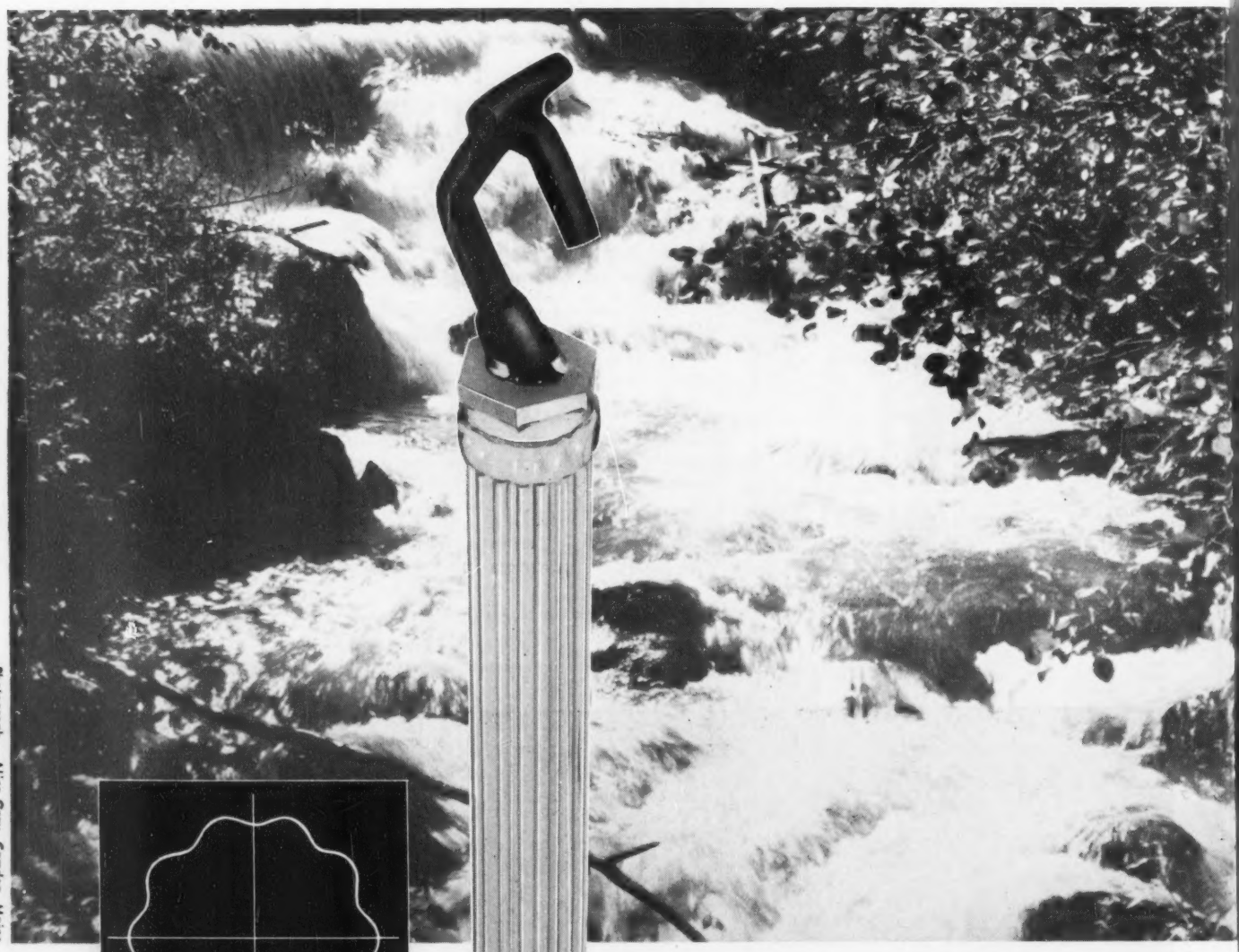
6.8% INCREASED CHROME PLATING WORKING SURFACE

New Alpha "RIPPLE ROUND"®

PAT. PENDING



Photograph — Alice Gray, Camden, Maine

The cross section drawing (left) clearly shows the unique construction of the Alpha RIPPLE ROUND anode. By adding the ripples to the round shape, Alpha has increased surface area 6.8% without increase in size, weight or price.

available in 1½" and 2" diameters

CONTACT YOUR PLATING DISTRIBUTOR FOR COMPLETE RIPPLE ROUND INFORMATION

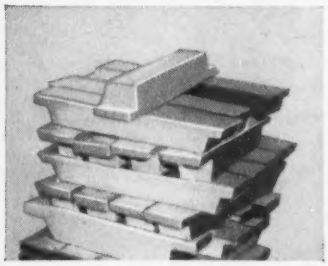
Anode *with* RAPID ACTION!

Deep ripples set into a round shaped anode is the secret behind the increased activity you can expect with a set of RIPPLE ROUND anodes in your tank. This latest chrome plating advance, by increasing the working surface, offers you maximum rapid action in your plating solution.

Look at these figures. A 2 inch smooth round anode has an active surface area of 6.28 inches, while the new 2 inch RIPPLE ROUND has an active surface of 6.7 inches. That represents an action increase of almost 7% — *without the slightest increase in size, weight or price.*

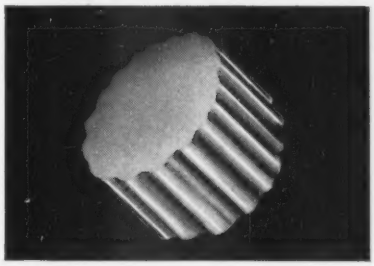
You'll find this active surface bonus a boon to your chrome plating operation. The new RIPPLE ROUND anode is truly the first advance in lead alloy anodes since the round anode was introduced some years ago. Try a set of Alpha RIPPLE ROUNDS today. Your distributor will be pleased to help you select the right size and amount for your tank.

ALPHA ANODES GIVE MORE BECAUSE THEY HAVE MORE TO GIVE



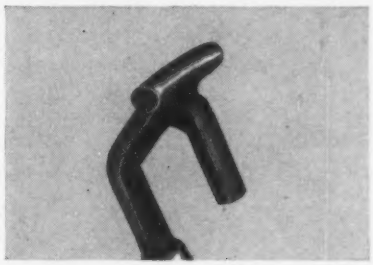
THE VIRGIN METAL STORY

In contrast with anodes made of re-smelted metal, which generally contain a high percentage of copper, Alpha uses virgin metals only. Destructive copper caused "POCKS", which cut down anode life, are never possible in Alpha anodes since copper content in virgin metal is always very low.



LONG LIFE

Ripple Round Anodes provide ample cross section to handle high current densities without over-heating. This increases the life of the anode because the high densities permitted produce uniform lead peroxide coatings which protect against costly anode corrosion. Since they not only run cooler but are also more rigid, due to their ripple round construction, the problem of warpage is eliminated. You'll also find that fewer RIPPLE ROUNDS are required in the tank because of their high current capacity



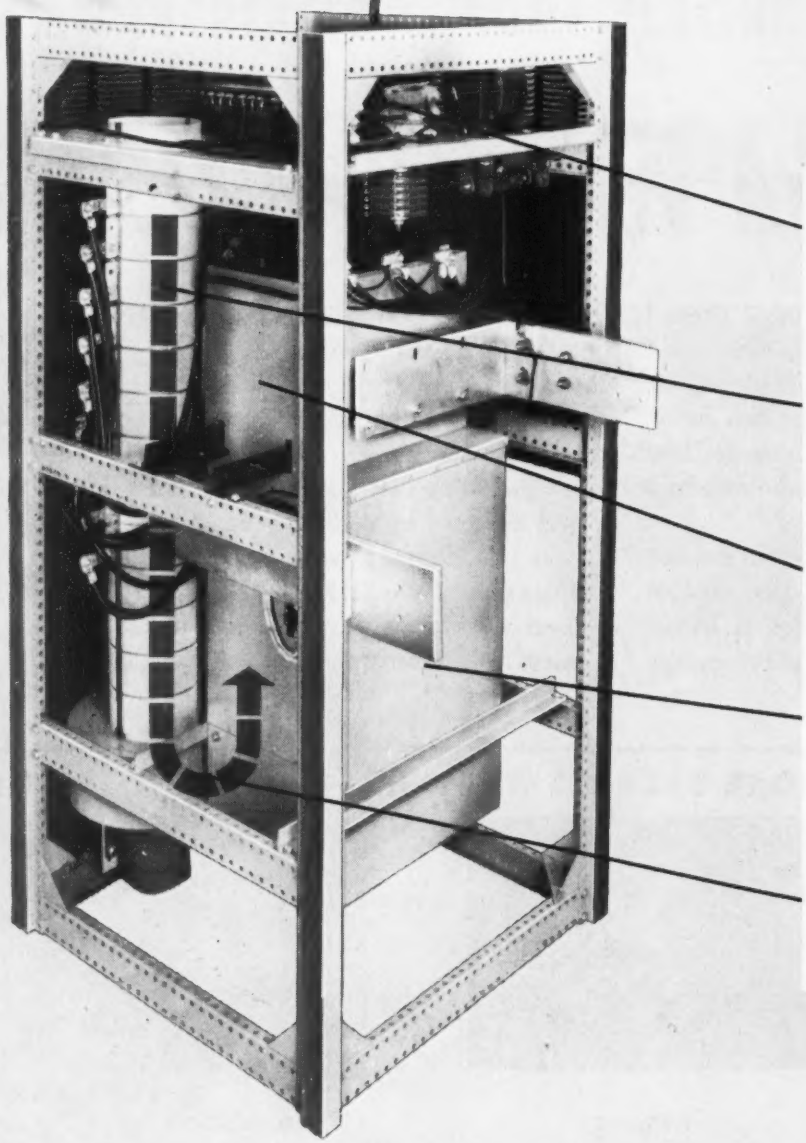
THE GOOD HOOK

Alpha hooks have a special "Easy Grip" feature which makes handling safe and easy. You have a choice of 6 "Easy Grip" hooks which are made in different lengths and different conductor bar openings assuring just the right hook for the job. Cast of high copper alloy, Alpha hooks offer top current carrying capacity and conductivity (most hooks will carry 250 to 300 Amps.). They're lead coated for protection and have special knife edges which assures a good bite and electrical control at the conductor bar. Plastic coatings may be applied to the hook for maximum protection.

ALPHA®

ALPHA METALS, INC.

56 WATER STREET
JERSEY CITY, NEW JERSEY



Automatic voltage control contains no moving parts or electronic tubes.

This tube contains time-proven General Electric germanium cells, each hermetically sealed in stainless-steel-ceramic enclosure for maximum corrosion resistance.

Transformer, protected by double-impregnation with alkyd-resin finish.

Reactor provides instant, stepless control plus built-in short-circuit protection.

Powerful blowers supply high-velocity cooling air blast (red line) past cells, through reactor and transformer.

General Electric announces a

TO: GENERAL ELECTRIC COMPANY
Section 463-15, Schenectady 5, N. Y.

Gentlemen:
Please send me bulletin GED-2934, "General Electric Automatic Germanium Plating Rectifier."

NAME_____

COMPANY_____

ADDRESS_____

CITY_____ ZONE_____ STATE_____

Progress Is Our Most Important Product

GENERAL ELECTRIC

RELEASE THIS MAN FOR MORE PRODUCTIVE WORK . . . no further need for him to continually correct output in order to get high-quality work. Just set it and forget it. This unit corrects faster, more accurately than the most-skilled operator. You get uniform power for most profitable plating.

NEW line of low-priced automatic germanium plating rectifiers

Examples: 9-volt/1500-amp, $1890; 12-volt/1000-amp, $1750

COMPLETE with remote automatic voltage control

Here's the biggest advance in plating rectifier technology since the introduction of germanium: *automatic control at low prices*!

With automatic control, you simply set the output you want on the remote-control panel. This output is maintained automatically, regardless of changes in tank load or variations in a-c input voltage. The result is a uniform product from rack to rack—not too much deposition, which wastes valuable anode material, time, and labor; not too little deposition, resulting in costly rework.

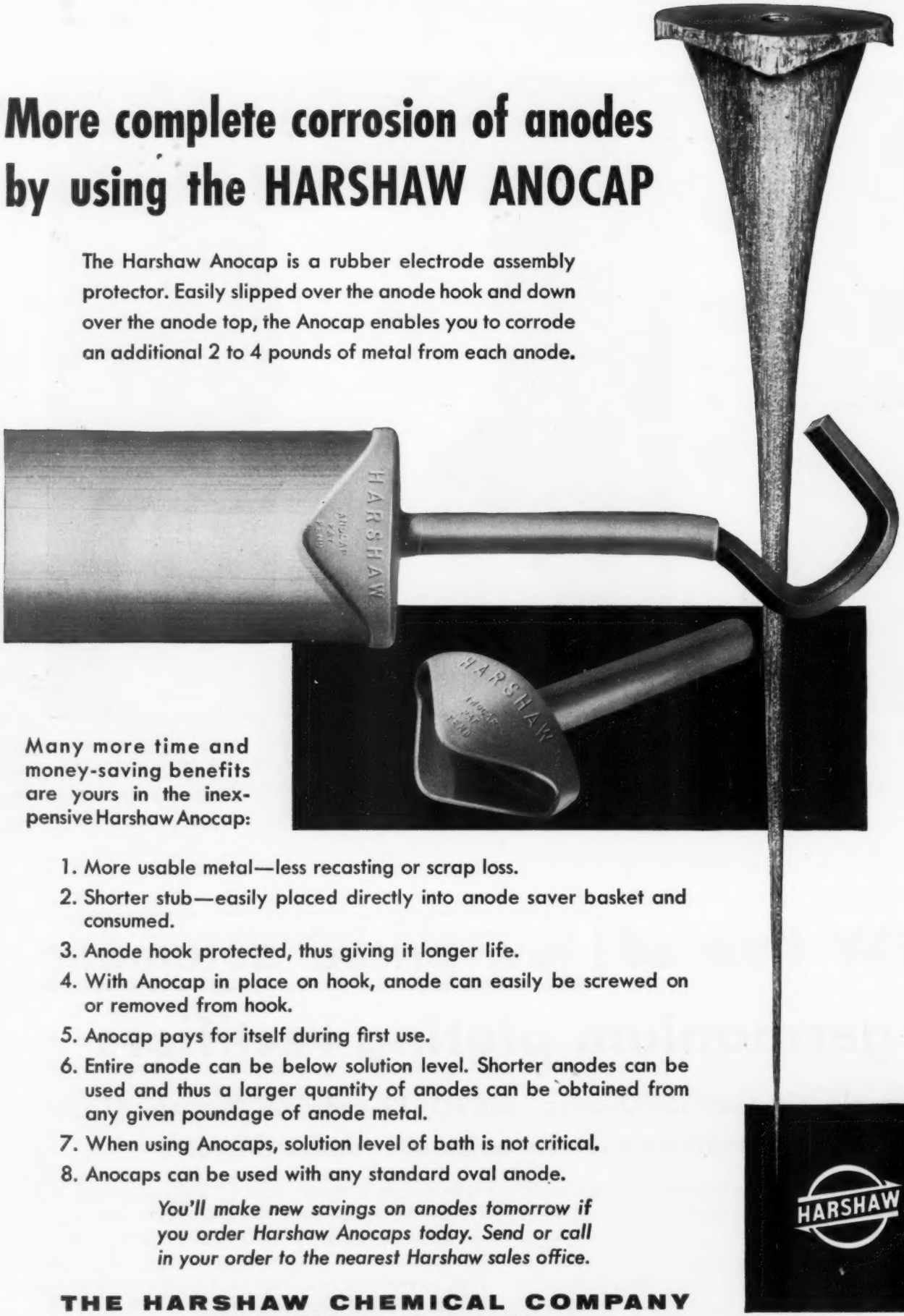
The low price results from: (1) successful adaptation to plating equipment of a low-cost saturable reactor circuit, long recognized as the ideal control; and (2) the perfection of a new cooling technique which cools the germanium cells from *both* sides and force-cools the reactor and transformer for long life.

Ratings *are now being built* from 6-volt/750-amp to 250-volt/140,000-amp, air-cooled and water-cooled. Ask your General Electric plating equipment supplier for more information, or send in the coupon for bulletin. General Electric Co., Schenectady 5, N. Y.

15/Circle on Readers' Service Card

More complete corrosion of anodes by using the HARSHAW ANOCAP

The Harshaw Anocap is a rubber electrode assembly protector. Easily slipped over the anode hook and down over the anode top, the Anocap enables you to corrode an additional 2 to 4 pounds of metal from each anode.



Many more time and money-saving benefits are yours in the inexpensive Harshaw Anocap:

1. More usable metal—less recasting or scrap loss.
2. Shorter stub—easily placed directly into anode saver basket and consumed.
3. Anode hook protected, thus giving it longer life.
4. With Anocap in place on hook, anode can easily be screwed on or removed from hook.
5. Anocap pays for itself during first use.
6. Entire anode can be below solution level. Shorter anodes can be used and thus a larger quantity of anodes can be obtained from any given poundage of anode metal.
7. When using Anocaps, solution level of bath is not critical.
8. Anocaps can be used with any standard oval anode.

You'll make new savings on anodes tomorrow if you order Harshaw Anocaps today. Send or call in your order to the nearest Harshaw sales office.

THE HARSHAW CHEMICAL COMPANY

1945 East 97th Street • Cleveland 6, Ohio

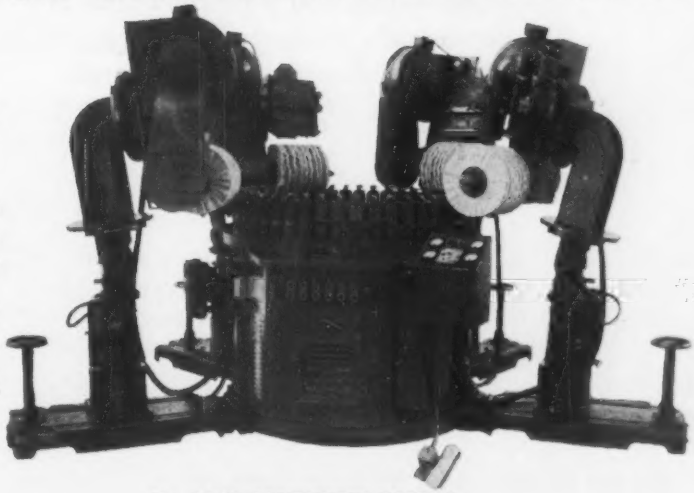
Chicago 32, Ill. • Cincinnati 13, Ohio • Cleveland 6, Ohio • Houston 11, Texas • Los Angeles 22, Calif.
Detroit 28, Mich. • Philadelphia 48, Penna. • Pittsburgh 22, Penna. • Hastings-On-Hudson 6, N. Y.

"I STILL PREFER MY FOUR-HEADED *PACKER-MATIC*"

Four or more heads on Packer automatics are the answer when polishing, buffing, or deburring production lags in your finishing room.

For handling long production runs, small odd-lot jobs or a mixture of both—Packer-Matics are easily adapted to many change-over setups, produce consistently better finishes in a fraction of hand operation time.

Packer-Matics are designed specifically to perform a multiplicity of jobs with an efficiency that will increase customer satisfaction and profit.



No. 14-45 CONTINUOUS ROTARY

OUR ENGINEERING STAFF INVITES YOUR INQUIRY.

PACKER-MATIC

AUTOMATIC MACHINES FOR BUFFING • POLISHING • DEBURRING

THE PACKER MACHINE COMPANY • MERIDEN, CONNECTICUT

All these and many more products can be finished less expensively with this plate

New Bronze Plating Discovery

eliminates buffing

...excellent corrosion resistance

minimizes need for nickel

Here's a revolutionary advance in electroplating—"Bright LUSTRALITE 10," a new process that gives you several important advantages.

The plate has remarkable leveling power, with a true bright finish that needs no buffing or polishing. Its outstanding corrosion resistance makes it an excellent substitute for nickel. It eliminates the need for a copper plating and can replace all or most of nickel plating normally required.

"Bright LUSTRALITE 10" produces a brilliant bronze that's fine-grained and hard . . . practical for both decorative and corrosion-protective purposes. Learn for yourself how it can help you speed plating operations, cut production costs and improve your products. It's available through the same distributors that handle other Battelle processes listed on the opposite side of this page.

. . . For more information about Battelle-developed processes, get in touch with any of these authorized Battelle Development Corporation distributors. Each is fully equipped to give you complete data and technical help.

EAST

THE ENEQUIST CHEMICAL COMPANY
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Be sure to read about "Bright LUSTRALITE 10" on the opposite side of this page . . .

other Battelle Processes that simplify plating, add beauty and improve products

Electropolishing

A wide range of finishes is available. Gives products new sales values. Extraordinary smoothing action produces a micro-polished effect. "True metal color" is achieved with a lustre not attainable with belts or wheels. Metal surfaces remain undamaged.

Electrodeburring—*A variation of electropolishing, excellent for smoothing sharp, burred metal for safe handling and precision functioning. Indispensible for parts having burrs in hard-to-reach places. For many items, electroburring plus electroplating produces the best possible and most economical finish.*

Chemical Polishing

Smooths as it brightens. Won't etch. Brings out basic lustre. Especially suitable for small parts and those of intricate design. Can be plated over. Easy to install and operate . . . requires only a tank and heating element.

STANDARD Bright Nickel

Produces mirror-like surfaces. Has excellent leveling action, ductility, and corrosion resistance. Very hard (Knoop 500-580) and wear resistant. On 18-gauge steel, can be bent around a ½-inch radius without cracking.

Tin Immersion

Coats copper and a variety of brasses and bronzes against "green water." Coats wires against corrosion. Easily controlled cold bath.

LUSTRALITE Electroplating Processes also include LUSTRALITE 20, a rich golden plate; LUSTRALITE 10, a deep bronze red; and LUSTRALITE 45, silver white, of sterling appearance. Data upon request.

Please let me have more information. I am particularly interested in the following Battelle processes:

_____

YOUR NAME _____

TITLE _____

FIRM NAME _____

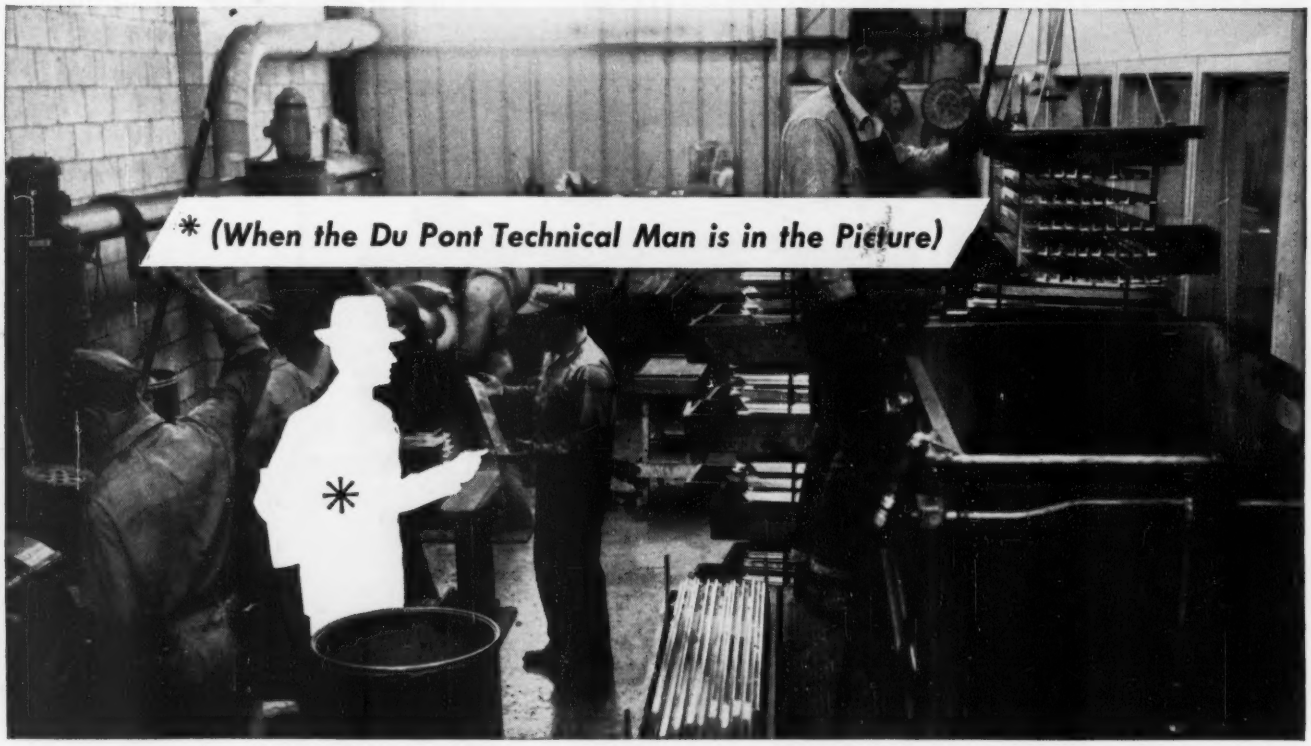
ADDRESS _____

CITY _____ **ZONE** ____ **STATE** _____

want more data?

mail coupon to distributor nearest you

You Get Practical Help on Vapor Degreasing of Metals



Your Du Pont technical man and your distributor for "Triclene" D trichlorethylene are but a phone call away when you need fast, practical help in vapor degreasing.

The broad experience of the Du Pont Technical Representative and the skill and facilities of Du Pont research and laboratories assure you of the finest in technical help. The Du Pont technical man's job is to help you keep your vapor degreasing at top efficiency—whether a complete analysis of your operation is required, or a quick solution to an immediate problem.

Call him direct, or ask your distributor of "Triclene" D for his services. They're yours for the asking. E. I. du Pont de Nemours & Co. (Inc.), Electrochemicals Dept., Wilmington 98, Delaware.

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REG. U. S. PAT. OFF.

BETTER THINGS FOR BETTER LIVING
...THROUGH CHEMISTRY

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Another Richardson Allen Engineering "First"

Demonstrating the same unsurpassed initiative, ingenuity and craftsmanship which, over the years, have set the pace of progress for the entire industry. Richardson-Allen engineers —working in close cooperation with Westinghouse engineers— have developed and perfected the ultimate in power rectification.

SILICON

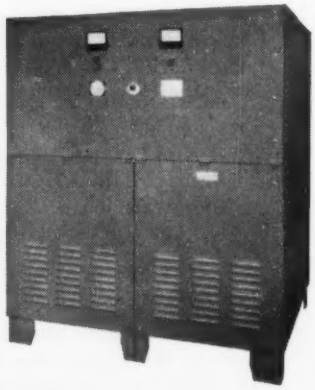
DEPENDABLE POWER RECTIFIERS

HERMETICALLY SEALED JUNCTIONS — HIGH TEMPERATURE OPERATIONS

VERSATILITY—Richardson-Allen silicon rectifiers are now available for the plating and industrial fields in ratings up to 500 kws.

EFFICIENCY—Richardson-Allen silicon rectifier units are now supplying major industries with an unprecedented amount of direct current—with no loss in efficiency, no aging and no apparent limit to the life of the silicon junctions. Single silicon junctions are designed to withstand up to 300 piv.

ECONOMY — Occupying unbelievable small space, the initial cost is often lower than other conversion methods; practically no maintenance is ever needed and when installation savings and power savings are figured the total amount is impressive.



For additional information, write to:

RICHARDSON ALLEN Corporation

DEPENDABLE RECTIFIER SPECIALISTS

a Manufacturing affiliate of

WESLEY BLOCK & CO., INC., 116-15 Fifteenth Ave., College Point, L. I., N. Y.

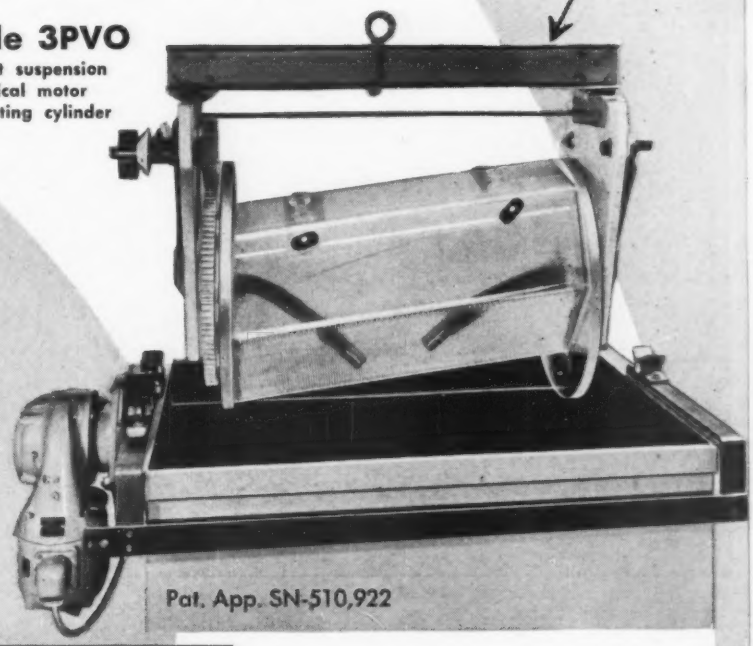
IN CANADA: Richardson-Allen of Canada, Ltd., 1236 Birchmount Rd., Scarborough, Ontario

BELKE DOUBLE OSCILLATION

Improves Plating Quality
Reduces Plating Time
Cuts Plating Cost

Eccentrically mounted cylinder oscillates as it rotates

Style 3PVO
3-point suspension
vertical motor
oscillating cylinder



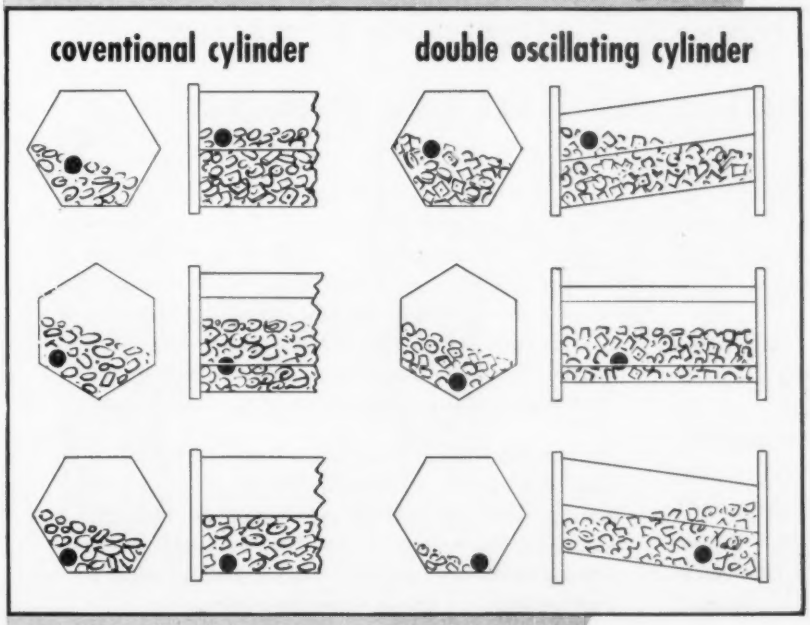
Pat. App. SN-510,922

Why!

Because the parts move up and down, back and forth, round and round. All faces are exposed. You get a specified thickness on all surfaces in less time.

See the difference

The diagrams below illustrate the difference in mixing action. The black spot represents a marked piece in the work.
Note how the black spot moves round and round in the conventional cylinder.
Then note how the black spot moves both around and across in the Double Oscillating Cylinder.



Mixes work the way a plating cylinder should

When you see this new multiple mixing action you'll agree it's the way a plating barrel should work and want no other kind.

Fortunately, all the new multiple mixing action comes from the cylinder. You can get wonderful improvement using the new cylinders with present equipment, but complete barrels designed throughout for double oscillation give even greater benefits.

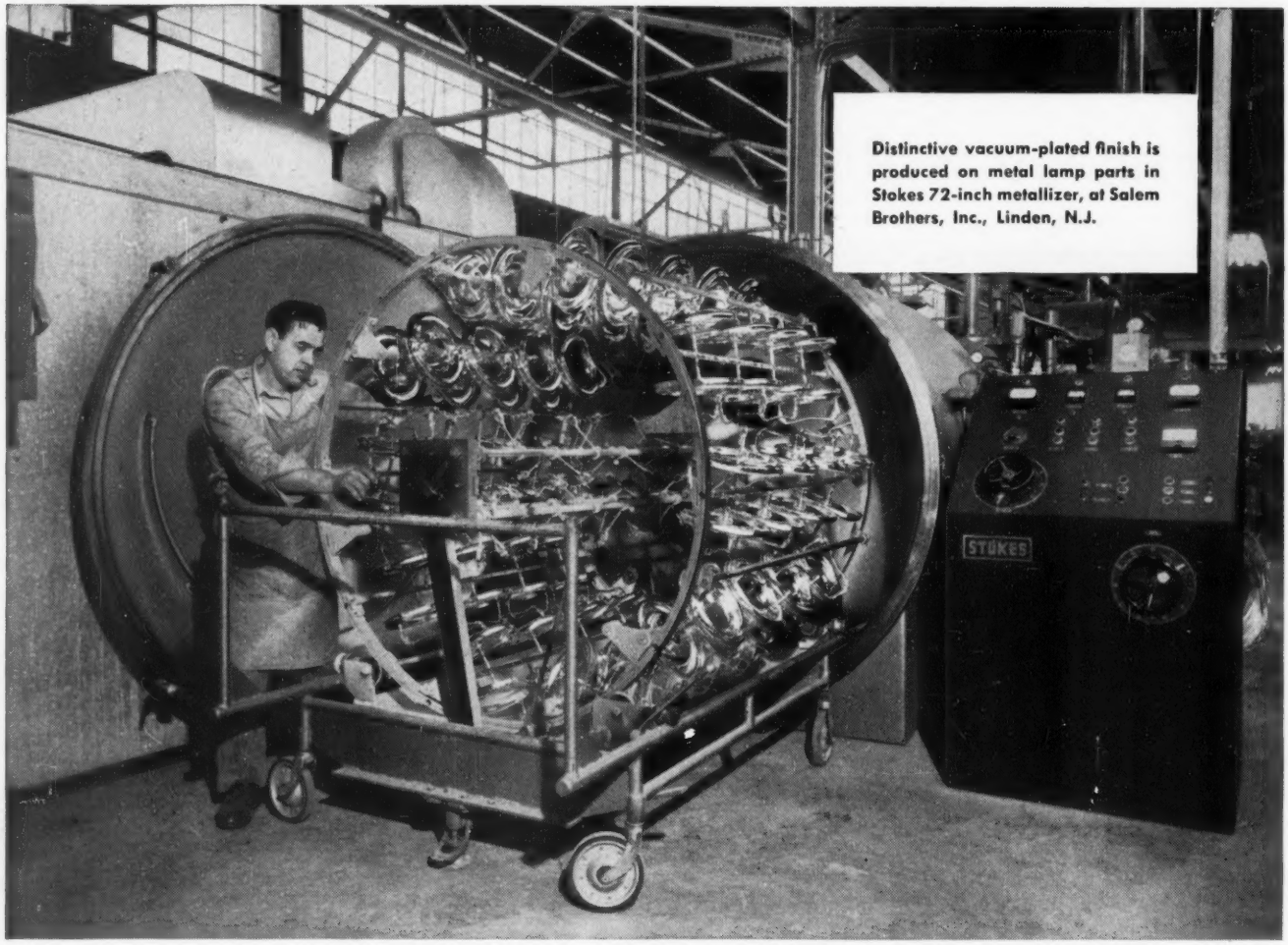
See your BELKE Service Engineer or send for literature.

14x30 and 14x36 cylinders carried in stock

BELKE Double Oscillating Cylinders are available in all sizes from 14x30 regulars to 6x12 portables.
Order a double oscillating cylinder for your hard to plate jobs. See the great improvement in plating quality and big saving in plating time.

Belke Manufacturing Company
947 N. Cicero Ave., Chicago 51

EVERYTHING FOR PLATING PLANTS



Distinctive vacuum-plated finish is produced on metal lamp parts in Stokes 72-inch metallizer, at Salem Brothers, Inc., Linden, N.J.

Attractive, low-cost vacuum plating ...sparks sales of SALEM lamps

One of the big reasons behind the success of TV and pin-up lamps made by Salem Brothers, Inc., is the attractive and durable finish produced in a Stokes vacuum metallizer.

The metallizing process gives a distinctive gold, brass, copper or chrome finish at costs considerably lower than electroplating . . . making it possible to offer smart, modern lighting fixtures at competitive prices. Good finish, according to Salem is especially important in the lamp business, for appearance is a major factor in acceptance by both the price-conscious merchandise buyer and the final consumer.

A Stokes 72-inch vacuum metallizer handles finishing at Salem Brothers at efficient, economical production rates . . . 1000 complete lamps a day. Interlocked centralized controls make it easy for men to learn the operating routine, and to produce to consistent quality standards with minimum labor. The equipment is compact and self-contained . . . takes little floor space.

Investigate this modern, low-cost method for finishing metals or plastics. Stokes can give you practical help in over-all planning . . . determine plant layout as well as production techniques, rates and costs . . . select lacquer and auxiliary equipment . . . train your operators.

High Vacuum Equipment Division
F. J. STOKES CORPORATION
5533 Tabor Road, Philadelphia 20, Pa.

STOKES

Brand New!

FOR BETTER BUFFING

Nankervis
Extended Automatic
Compound Applicator

FEEDS 10 INCHES WITHOUT RESETTING . . .

The Model 1006 is a brand new addition to the line of Nankervis Automatic Compound Applicators used throughout the Metal Finishing Industry. It was developed to enable a full 10 inches of compound to be applied without resetting or adjustment. Many other new features have also been added to make this Applicator a real pacemaker in the line. It is air operated, fully automatic, easily installed, and can be operated in any position.

Nankervis Applicators can save you up to 40% of your buffing costs. Check these advantages against your present buffing methods. Buff life is increased because just the right amount of compound is applied—with no burning or glazing. Just the right amount of compound means no waste either . . . *ALL* the compound is applied to the work. Rejects are reduced because buffing is uniform. It's cleaner too!

Write today for more information. Let us prove to you that Nankervis Applicators can save you money. Ask for bulletin Number A-1000.

GEORGE L. Nankervis COMPANY

EQUIPMENT AND SUPPLIES FOR THE METAL FINISHING INDUSTRY

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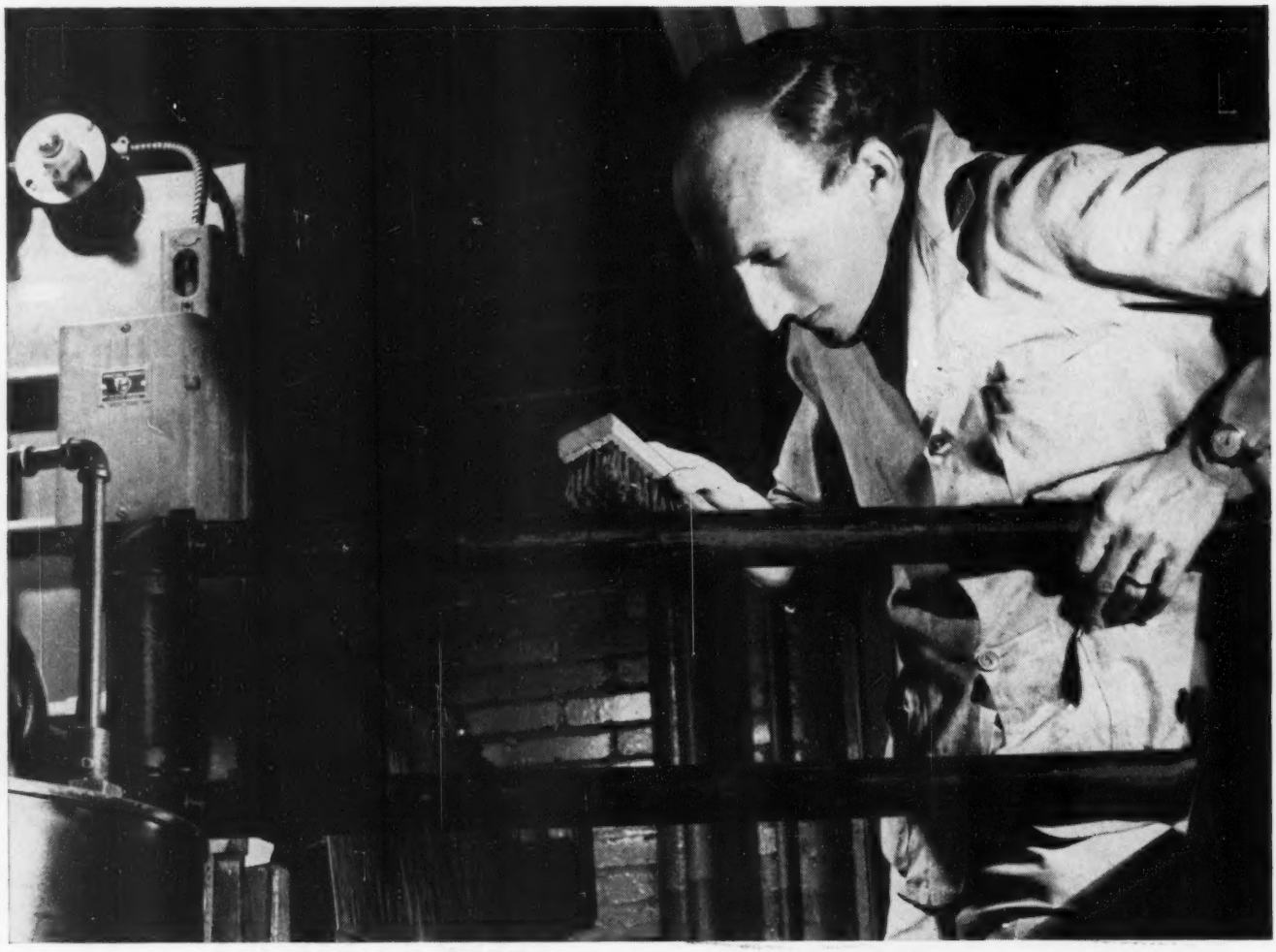

Do heating coils in your vapor degreaser often get gummed up like this? You may be using a degreasing solvent that's poorly stabilized. Read below how you can minimize this coil-cleaning job, and degrease more parts between cleanouts.

Why Nialk® TRICHLORethylene with **psp** gives you **more degreasing, less downtime**

Cut your degreasing costs with this permanently stabilized solvent

It's the *stabilizer* in the trichlorethylene that determines how long you can use it safely and efficiently.

Light, heat, air, acids, and active metals such as aluminum, given time, can break down improperly stabilized trichlorethylene, making it unfit for further degreasing.

Only Nialk TRICHLORethylene has **psp**

The stabilizer in NIALK TRICHLORethylene has **psp**—permanent STAYING power. It's neutral, non-alkaline. You *never* have to replenish it.

Only NIALK has this *permanent staying power*. Even after repeated distillations, its unique stabilizer prevents acid formation and other causes of breakdown.

NIALK works equally well with *all* metals.

psp means cheaper degreasing—here's why

You don't have to clean out your degreaser nearly so often with NIALK TRICHLORethylene. You can degrease many more parts between cleanouts.

The NIALK stabilizer actively retards formation of degradation products in your degreaser. Cleanouts are easier, faster.

Get proof of Nialk's cheaper, safer cleaning

See for yourself how NIALK TRICHLORethylene with **psp** stays stable, keeps cleaning efficiently long after other solvents have lost their punch. Write on your business letterhead for a revealing resumé of comparative metallurgical tests on five leading brands.

HOOKER CHEMICALS PLASTICS

HOOKER ELECTROCHEMICAL COMPANY

1301 UNION STREET, NIAGARA FALLS, N. Y.

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Manufacturers of VIRGO® DESCALING SALT, VIRGO ELECTROLYTIC SALT, VIRGO MOLTEN CLEANER

8-1608

A Timely Message on

Disappearing Manpower

by Ben P. Sax

Chairman of the Board, American Buff Company

Statisticians forecast a prolonged period in which all of us, in every industry, face an ever-toughening problem of shrinking labor pools. The situation demands new means and new ideas which can compensate for fewer hands.

It is heartening to review the closing year's progress in increasing the productivity of workers far beyond their previous limits. Our own Metal Finishing Industry has kept pace by the introduction of wonderful, new devices which enable workers to multiply their effectiveness many times over.

Automation in many forms not only is yielding important benefits to employers, but also is making possible continued operation of plants otherwise crippled by help shortages. Modern air-cooled buffs with safe, high speeds are cutting per-unit production costs and selling prices. This in turn creates increased product demand.

Improved types of buff materials are doing a giant job of slicing overhead in finishing operations on parts and products for consumer and industrial uses. New chemical miracles have produced sisal fibres with super workability and wider usefulness which contribute to overall savings. Our own company has perfected a system of pre-assembly for buffs, which cuts change-over and down-time to a tiny fraction of previous methods.

We at American Buff, feel that the Metal Finishing Industry is our family. Overcoming its handicaps is a personal challenge we have always assumed with enthusiasm. As we review the past year, we can count satisfying successes. With our thanks for your warm acceptance of our measures against manpower shortages, we extend our sincere wishes for your growing prosperity in the wonderful world of tomorrow.

Sincerely,

Ben P. Sax

NEW ...from Du Pont

Improved "Zin-O-Lyte" Brightener Saves Money in Barrel Plating Zinc

NEW "ZIN-O-LYTE" BRIGHTENER SPECIAL

Gives brilliant zinc deposits... right from the barrel... without a bright dip

Now you can get top quality, brilliant zinc plating direct from the barrel without a bright dip, by using "Zin-O-Lyte" brightener—SPECIAL. The new formulation, fully tested in production installations, is designed specifically to cut your brightener costs with no sacrifice in quality of work.

"Zin-O-Lyte" Brightener SPECIAL is compatible with other Du Pont zinc brighteners and generally can be used without change in procedure.

The new "Zin-O-Lyte" brightener is available in non-returnable Fibrepak drums which minimize breakage . . . reduce shipping costs. This readily soluble powder also gives you freedom from freezing or settling out of brightener constituents in storage or transit.

New "Zin-O-Lyte" Brightener SPECIAL is a part of Du Pont's extensive line of plating chemicals. For complete information and arrangements for trial use in your plant, please call or write to our nearest district office or: E. I. du Pont de Nemours & Co. (Inc.), Electrochemicals Department, Wilmington 98, Del.

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DU PONT *Chemicals • Processes • Service*
for **ELECTROPLATING**

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BETTER THINGS FOR BETTER LIVING... *THROUGH CHEMISTRY*

new, fast, ALKALINE *De Ruster* #2

Does not attack ferrous metals

Non toxic

Economical

No hydrogen embrittlement

No dimensional changes

Also removes paints, oils

Alkaline De Ruster No. 2 is the new Mitchell-Bradford non-electrolytic compound for removing rust quickly from ferrous metals. Since it concentrates its action on the rust itself, it produces no dimensional changes yet leaves the surface not only clean but without the tendency to re-rust.

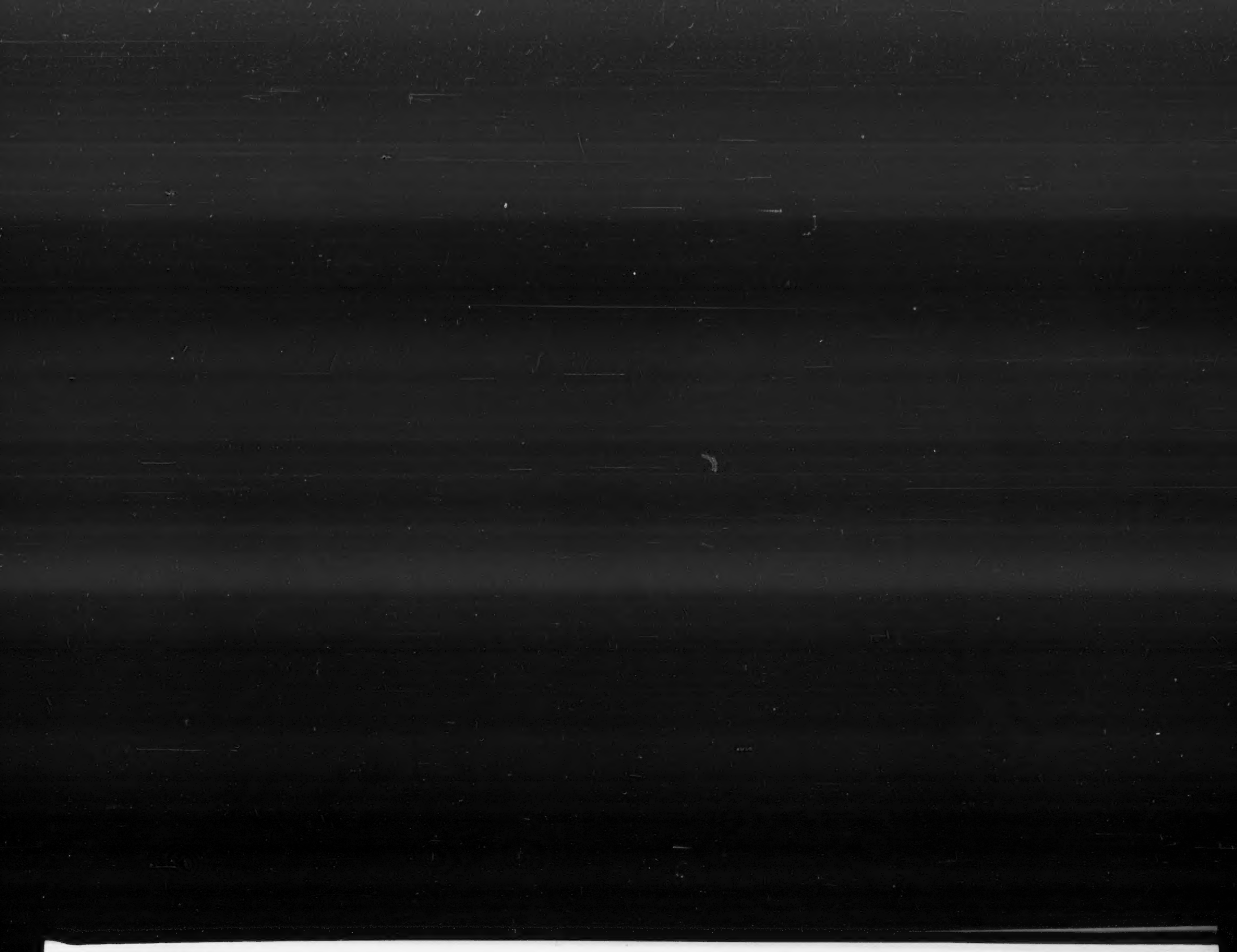
Alkaline De Ruster No. 2 contains no dangerous acids, produces no harmful fumes. This eliminates the risk of hydrogen embrittlement and produces a surface ideal for subsequent finishing processes such as plating, phosphating, black oxidizing, etc. Alkaline De Ruster No. 2 is used in various concentrations in water of 180° to boiling. It is economical, safe to use, completely dependable. Write us about your rust removal problem!

Mitchell-Bradford

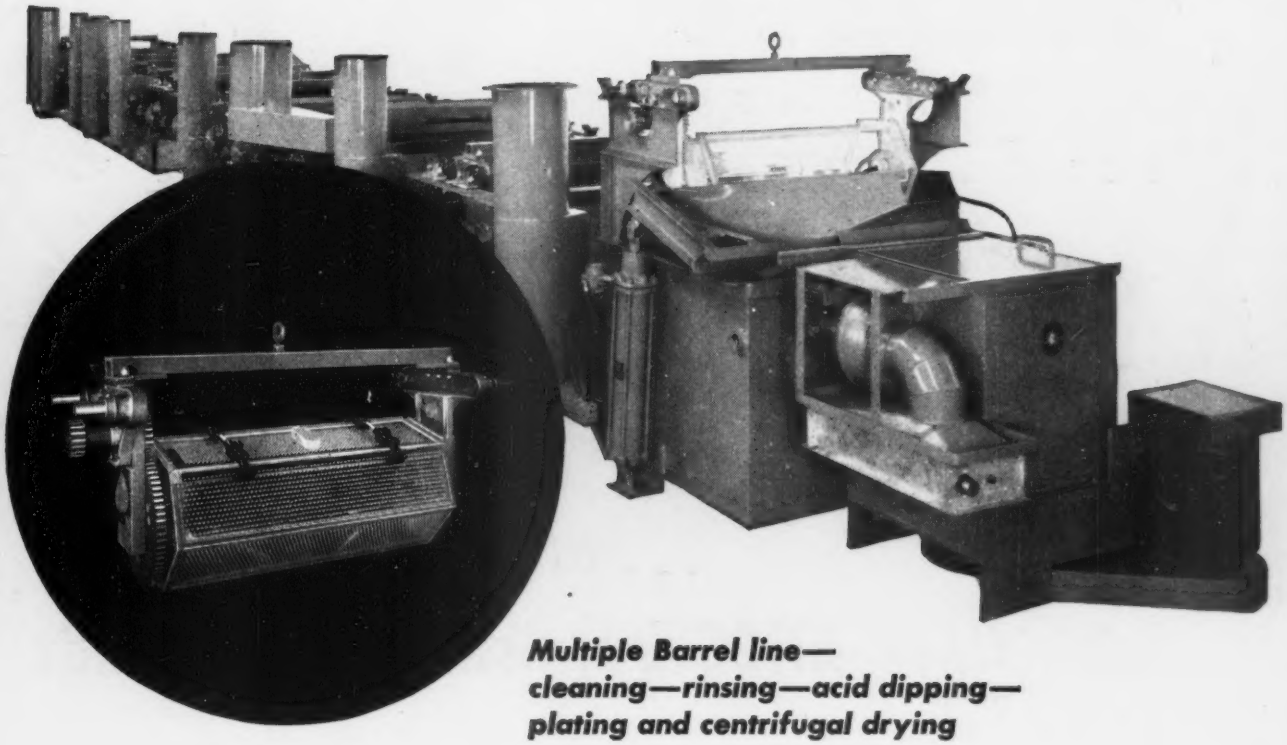
MITCHELL-BRADFORD CHEMICAL CO.

WAMPUS LANE MILFORD, CONNECTICUT

QUALITY PRODUCTS OF CHEMICAL RESEARCH



CROWN PLATING BARRELS



Multiple Barrel line—
cleaning—rinsing—acid dipping—
plating and centrifugal drying

CROWN LUCITE CYLINDERS

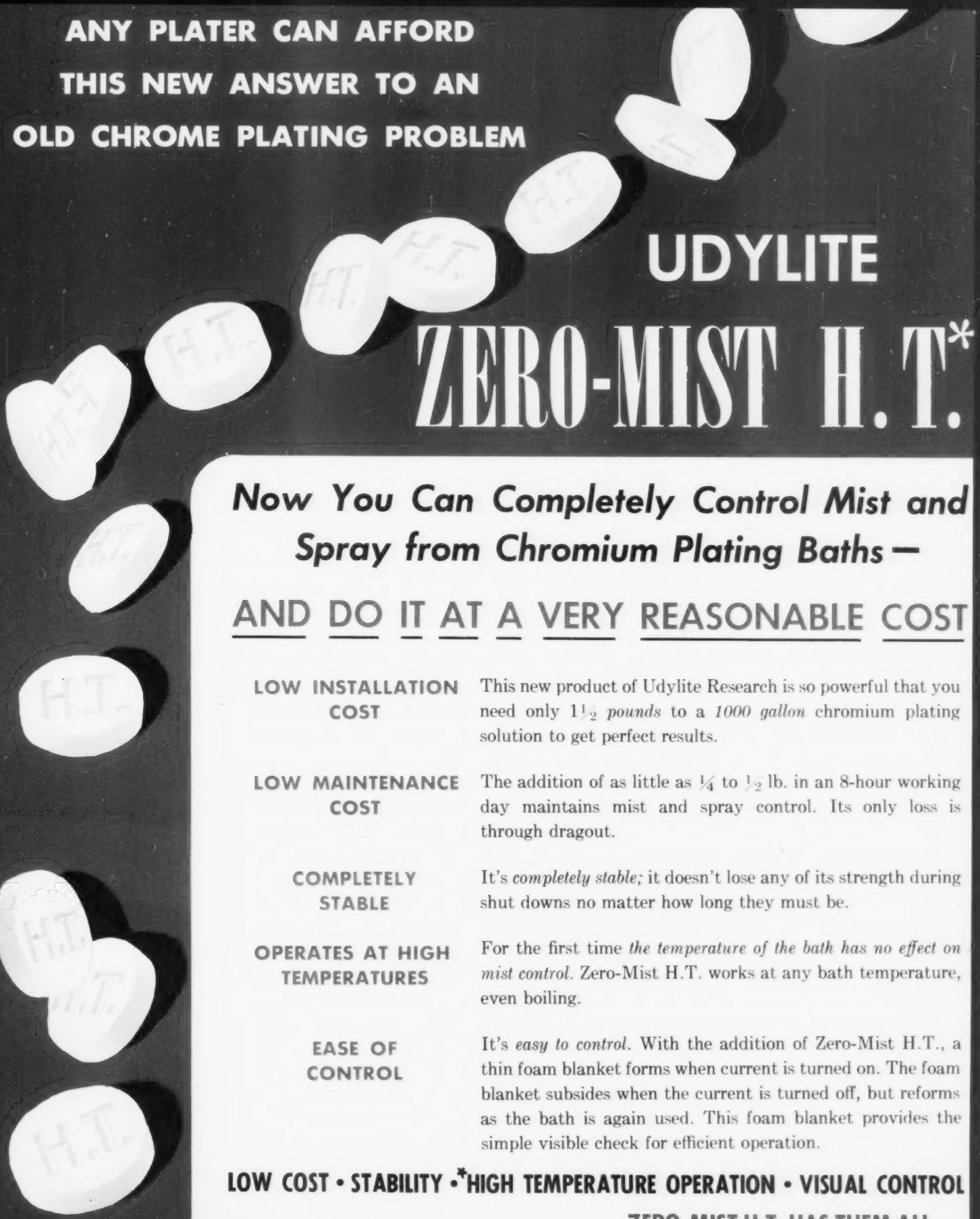
Can be operated through the entire cycle
cleaning—rinsing—acid dipping—and plating solutions.

Whether your production requires a single barrel
or a multiple set up for cleaning, rinsing, acid dipping, and
plating, there are Crown barrels to fit the job.

Write for complete details

CROWN RHEOSTAT AND SUPPLY COMPANY
3465 N. KIMBALL AVENUE • CHICAGO 18, ILLINOIS

ANY PLATER CAN AFFORD
THIS NEW ANSWER TO AN
OLD CHROME PLATING PROBLEM



UDYLITE
ZERO-MIST H.T.*

Now You Can Completely Control Mist and Spray from Chromium Plating Baths —

AND DO IT AT A VERY REASONABLE COST

LOW INSTALLATION COST

This new product of Udylite Research is so powerful that you need only 1½ *pounds* to a *1000 gallon* chromium plating solution to get perfect results.

LOW MAINTENANCE COST

The addition of as little as ¼ to ½ lb. in an 8-hour working day maintains mist and spray control. Its only loss is through dragout.

COMPLETELY STABLE

It's *completely stable;* it doesn't lose any of its strength during shut downs no matter how long they must be.

OPERATES AT HIGH TEMPERATURES

For the first time *the temperature of the bath has no effect on mist control.* Zero-Mist H.T. works at any bath temperature, even boiling.

EASE OF CONTROL

It's *easy to control.* With the addition of Zero-Mist H.T., a thin foam blanket forms when current is turned on. The foam blanket subsides when the current is turned off, but reforms as the bath is again used. This foam blanket provides the simple visible check for efficient operation.

LOW COST • STABILITY • *HIGH TEMPERATURE OPERATION • VISUAL CONTROL

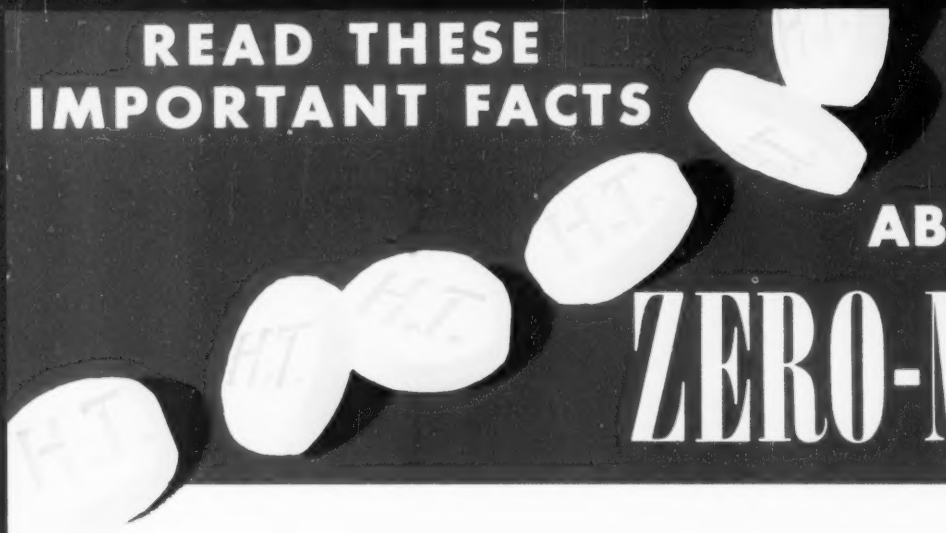
ZERO-MIST H.T. HAS THEM ALL

THE Udylite CORPORATION
DETROIT 11, MICHIGAN

WORLD'S LARGEST PLATING SUPPLIER

FOR FURTHER DETAIL SEE NEXT PAGE

READ THESE IMPORTANT FACTS



ABOUT THE *NEW*

ZERO-MIST H.T.*

ZERO-MIST H.T.

Is a completely stable, powerful surface active additive for chromium plating baths. When added to chromic acid plating solutions it forms a foam blanket which completely eliminates mist and spray. It is indestructible *even at high temperatures.* Additions of Zero-Mist H.T. are required only to replace dragout losses.

ONLY A SMALL QUANTITY IS REQUIRED

The concentrated formula of Udylite Zero-Mist H.T. means that only a small amount is required for the solution. Tests conducted over many months have shown that only one to one-and-one-half pounds of Zero-Mist H.T. are usually required for 1000 gallons of chromic acid solution. This creates a foam blanket about ½" to 1" thick which holds back all mist and spray.

EFFECTIVE IN HIGH TEMPERATURE BATHS

Zero-Mist H.T. controls mist and spray regardless of the temperature of the plating solution. It works as well at high temperatures as it does in low temperature solutions. The most concentrated boiling chromic acid solutions in no way affect its efficiency nor does it cause a breakdown of its chemical properties nor is it affected by the highest anode or cathode current densities used in chromium plating.

IMPROVES HEALTH CONDITIONS

Improvement of health conditions in the plating room is evident immediately when Zero-Mist H.T. is used. Occupational hazard is also reduced with the elimination of spray. Cross currents of air do not blow chromic acid mist in the air of the plating room, a fault common to wide tanks which are difficult to ventilate, as well as tanks of normal width located near open doors or windows.

VISUAL CONTROL

The foam blanket, which is always visible tells you if additions of Zero-Mist H.T. should be made. Zero-Mist H.T. is indestructible, but dragout does cause a need for occasional additions. Usually only a fraction of a pound is required per 8 hour work shift. Once the chromic acid solution is charged with Zero-Mist H.T. the foam blanket appears immediately with the use of the solution. If Zero-Mist H.T. is producing a satisfactory blanket when the tank is shut down, it is not necessary to add more when starting up again, regardless of the time interval, since Zero-Mist H.T. is completely stable.

ELIMINATES WASHING OF EXHAUSTED AIR

When Zero-Mist H.T. is used there is no need for washing the exhausted air. Ventilating systems stay cleaner and require very little maintenance thereby saving many dollars to the chrome plater each year.

GUARANTEED BY UDYLITE

Zero-Mist H.T. is guaranteed by Udylite to be the finest and most economical surface additive for chromic acid baths you have ever used. Order a sample of this remarkable new product today.

THE Udylite CORPORATION
DETROIT 11, MICHIGAN

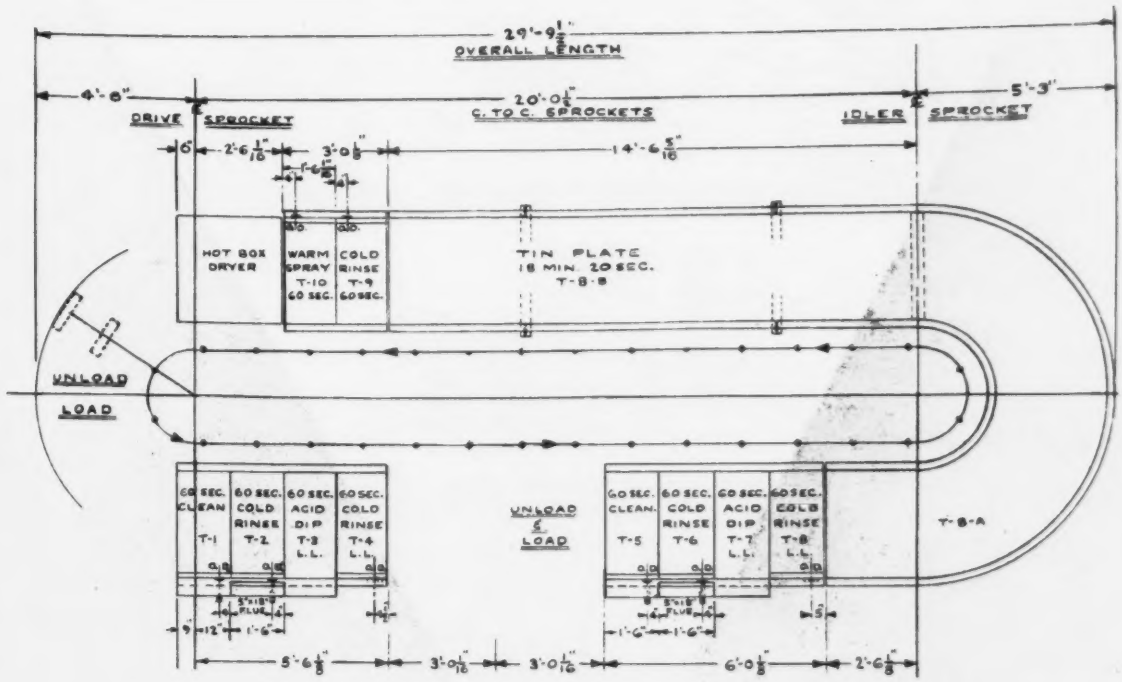
BUY OF THE MONTH!

HANSON-VAN WINKLE-MUNNING FULL AUTOMATIC

ELEVATOR TYPE, TWIN ROW

IN EXCELLENT WORKING CONDITION

UNIT MAY BE CHANGED TO PRACTICALLY ANY CYCLE YOU DESIRE.



GENERAL LAYOUT

OVERALL HEIGHT 9′ 2½″ — OVERALL WIDTH 11′ 2″ — HEIGHT OF LIFT 30″ — CARRIER CENTERS 18″ — 32 CARRIERS — 20 SECOND (VARIABLE) TRANSFER TIME — 60 SECOND (VARIABLE) IMMERSION TIME — TANK DEPTH 36″ — RACK SIZE APPROXIMATELY 24″ x 14″. NEW — 1948. COMPLETE PRINTS ON REQUEST. LOCATED IN BOSTON. LOADING NO PROBLEM.

OUR BUSINESS IS AS GOOD AS OUR REPUTATION

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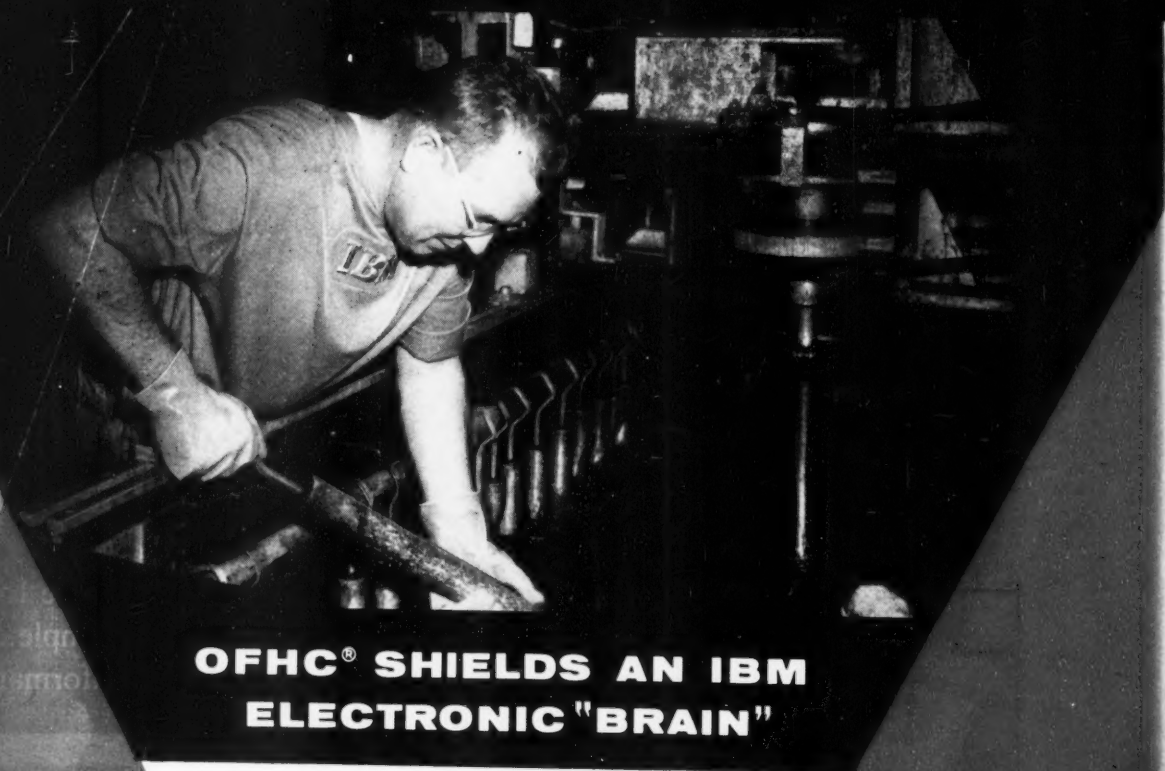
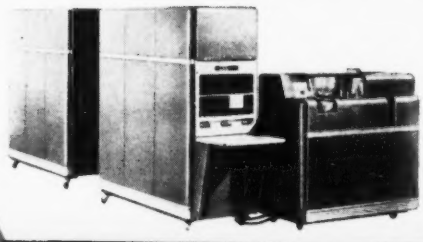
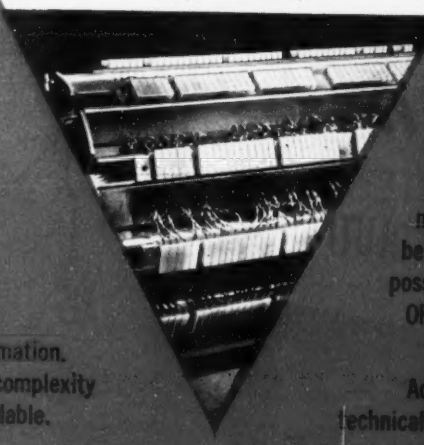


OFHC® SHIELDS AN IBM ELECTRONIC "BRAIN"





OFHC Anodes provide high-density copper plate for computer "memory drums"

The "memory drum" of the IBM 650 Magnetic Drum Data Processing Machine can store 20,000 different items of information. The functional accuracy of a unit of this complexity relies on use of the finest materials available.

AMCO is proud to contribute to the accuracy of the IBM 650 through the use of its OFHC Copper Anodes. OFHC Anodes meet the exacting specifications required for plating the rotor of the memory drum. The copper plate acts as a barrier between the steel shell of the rotor and the rotor's magnetic coating. The plate must therefore be of the highest possible density and lowest possible porosity. The purity and uniformity of OFHC Anodes provide the smooth surface so necessary in this application.

Additional information on OFHC Anodes and technical assistance on any copper plating problem available on request.

OFHC® COPPER ANODES

are manufactured only by

Metal Sales Department

THE AMERICAN METAL COMPANY, LTD.

61 Broadway, New York 6, N. Y.


US
EQUIPMENT
SINCE 1896
For Plating Anodizing Metal Cleaning, Pickling, Acid Dipping, Drying and Related Operations
FULLY AUTOMATIC SEMI AUTOMATIC
MANUALLY OPERATED
PLATING BARREL APPARATUS
STILL TANK PLATING EQUIPMENT
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WHERE PLATERS AND FINISHERS LOOK FOR INFORMATION
FINISHING PUBLICATIONS, INC.

METAL FINISHING

DEVOTED EXCLUSIVELY TO METALLIC SURFACE TREATMENTS

JANUARY, 1957 Volume 55 Number 1

FEATURES

DEPARTMENTS

Published Monthly By
Finishing Publications, Inc.
Established in 1903 as Metal Industry by Palmer H. Langdon 1868-1935.
Also publishers of ORGANIC FINISHING and annual GUIDEBOOKS and DIRECTORIES.
381 Broadway, Westwood, N. J.
WEstwood 5-1530

L. H. Langdon, *President-Treasurer;* Palmer H. Langdon, *Publisher;* Thomas A. Trumbour, *General Manager;* Joan T. Wiarda, *Sales Manager;* Nathaniel Hall, *Technical Editor;* Fred A. Herr, *Pacific Coast Editor;* John E. Trumbour, *Equipment & News Editor;* Inez Oquendo, *Assistant Editor;* Elizabeth Meyers, *Circulation Manager.*

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United States and Canada $4.00 per year, other countries $8.00. Single copies 45c in United States and Canada, other countries 85c. GUIDEBOOK-DIRECTORY 25th edition 1957 current, 642 pages 5¼x7⅞, subscriber's edition $2.00 per copy, deluxe edition $3.50 per copy. Please remit by check or money order; cash should be registered. Request for change of address should reach us on or before the 15th of the month preceding the issue with which it is to go in effect. In sending us your change of address, please be sure to send your old address as well as the new one. It is difficult and often impossible to supply back numbers. Re-entered as second class matter June 13, 1940 at the post office at New York, N. Y. under the Act of March 3, 1879.

Member

Audit Bureau of Circulations

Society of Business Magazine Editors

New process gives more corrosion-proof chromium plated finish

Savings in bright finishing start with the copper

Deposits from Unichrome Copper are so smooth, they reduce copper buffing time or help eliminate it entirely. Containing no cyanides, the pyrophosphate plating solution cuts costs of waste-disposal also.

While these two features prove most valuable to users of Unichrome Copper, there are many other operational advantages offered. Send for full data.

What's been happening in chromium plating?

Major improvements in chromium plating in recent years have been due to characteristics of the Unichrome SRHS® Chromium Bath.

With its *speed,* SRHS Chromium helped cut plating time up to half. With its *self-regulation,* it simplified control for optimum plating balance. With its wider *bright plate range,* it cut down misplates. With its higher *cathode efficiency,* it saved power and stepped up production capacity of equipment.

These improvements are well documented by the records of hundreds upon hundreds of plants.

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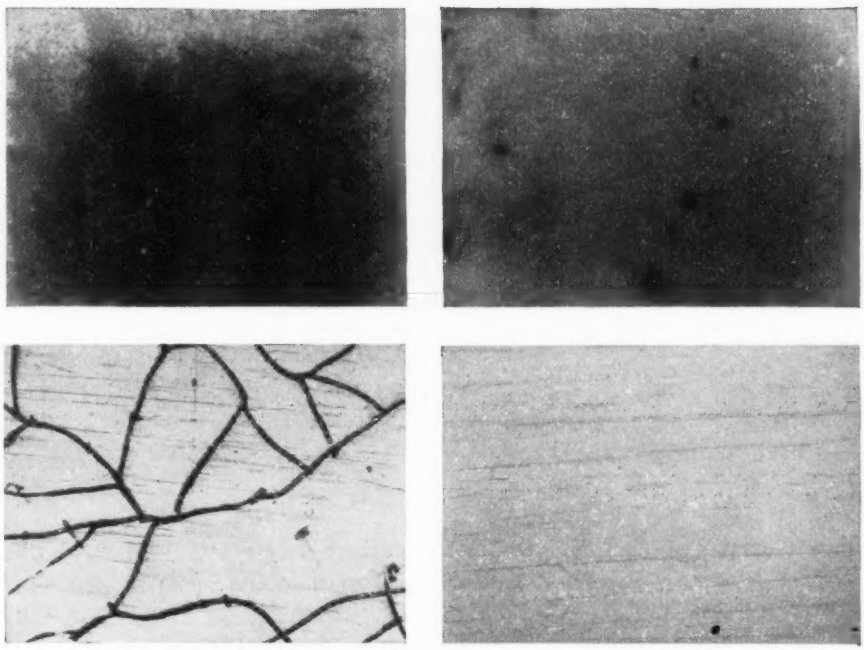


Top: (Left) After many months outdoors, a .0005" deposit of ordinary chromium, plated directly on steel, was rust-covered; (Right) Crack-Free Chromium, same thickness, was virtually unaffected. Bottom: (Left) Photomicrograph of etched ordinary chromium shows network of microscopic cracks. (Right) Etched Crack-Free Chromium deposit shows no such imperfection.

Experience with a relatively new kind of chromium finish reveals a most important difference in serviceability. This difference is graphically shown above. Unichrome Crack-Free Chromium Plating proves definitely, measurably superior to ordinary chromium for certain types of applications . . . notably those where durability and protection are paramount.

REASONS WHY

Crack-Free Chromium is *structurally* different from ordinary chromium plate. It does not develop the typical network of microscopic cracks—even in thicknesses specified for "hard" chromium plating. Corrosives find no path to the underlying base metal. Rusting is blocked.

Crack-Free Chromium can be plated directly on steel or zinc base die castings. It does not depend on an undercoat of scarce nickel for long life.

OTHER ADVANTAGES

In other ways, too, the new finish proves superior to ordinary chromium. It resists thermal shock and gives better protection at elevated temperatures. It gives improved non galling, non seizing properties.

A satin, matte finish, Crack-Free Chromium can be left as is, or readily buffed to high luster. Ask for recommendations, or send for Bulletin CFC-1.

METAL FINISHING

DEVOTED EXCLUSIVELY TO METALLIC SURFACE TREATMENTS

ESTABLISHED 1903 VOLUME 55 • NUMBER 1 • JANUARY, 1957

The Outlook for 1957

January is customarily the month for forecasts so a brief glance is in order at this time at what is in store for the metal finisher.

Business, in general, has been holding at a steady level. An increasing number of manufacturers, attempting to fill open time in their finishing departments by soliciting contract finishing, have been quoting very low prices, based on their regular production absorbing the fixed charges for the equipment and accounting for most of the profit. As a result, many independent job shops are finding it hard sledding, with the scramble for work at almost any price, in order to compete with the captive job shops, showing up on the books as good gross but no net. There is no obvious answer to this problem and, if the rate of manufacture should decrease in coming months, the situation might deteriorate still further. Of course, a business upturn will not only improve the contract finisher's position as a result of more work from his customers, but will find the captive shops with less open time for outside work at fill-in prices. In the meantime, the job shops will have to live in hope.

There have been no important strikes recently to affect the supply situation, and this happy state bids fair to continue, so far as the finisher is concerned. We hope this forecast doesn't influence users to cut their inventories of chemicals, anodes, and other supplies to the bare minimum. It has been emphasized on many an occasion that a few pounds of anodes and salts go a long way, and even a moderate supply inventory is very inexpensive insurance against any unforeseen developments which could change the picture overnight.

Metals appear to be readily available and are expected to remain that way. Were it not for the nickel shortage, the outlook would be very favorable. The diversion from the government stockpile of 74.3 million pounds during 1956 was of no consequence to this industry since it all went to defense projects. Some hope had been expressed that the decreased auto output last year would result in readier nickel availability and a common plaint late in the year was "what happened to the 5 million pounds which were not used on cars?" We might point out that there is an important difference between *consumption* and *demand*. With every nickel installation low in anodes, no one in his right mind can be expected to refuse anodes just because, at the moment, his consumption happens to be low.

It appears that a fairly normal year is ahead and if, as is planned, ODM foregoes, as it has for the first quarter, or decreases the amount it skims off the top of nickel shipments from refiners each month, much of the prevailing uncertainty will rapidly vanish.

Technical Developments of 1956

By Nathaniel Hall, *Technical Editor*

Cleaning

DURING the past year the literature on metal finishing turned out to be quite voluminous, especially in the patent department. However, in the fields of cleaning and degreasing there was very little to report, and that mainly in the form of patent claims. *Degreasing* was covered by two patents, one to Ruggles[1] on a *spray method* for fragile articles, and the other to Kearney[2] on an improvement in *solvent vapor degreasers*. Alkaline cleaning was the subject of two articles worth reporting. Young[3] describing the material which goes into *cleaners, surface contaminants, and their removal;* while Hightower[4] discussed the fairly new process of *ultrasonic cleaning.*

A fairly good number of new formulations for alkaline cleaners appeared during the year, practically all claiming inhibiting properties. Addition of nitrogen-containing compounds to a polyphosphate *cleaner for copper* was disclosed by Sylvester[5] and by Ruff[6]; the use of 2-8% by weight of *ferricyanide as an addition agent* was suggested by Duncan;[7] and, for *etching and cleaning aluminum,* Pullen & Swann[8] patented addition of minor amounts of dinitrotetramine cobaltic chloride to the alkali. For the same metal Reissig[9] claimed the addition of sodium lignosulfonate to control *scale formation* and Newman proposed a solution of alkali and citrate.[10]

Electrolytic cleaning in *fused salt baths,* which has a number of important advantages although not as popular as aqueous solutions, was covered in two patents, one to Webster & Thomas[11] and the other to Webster alone.[12]

The field of *abrasive blasting* was a slightly more active subject in the literature than during the previous year, accounting for two articles and a goodly number of inventions. The techniques for different methods were the subject of an article by Anderson,[13] and the applications of *liquid blasting* were detailed by Bradshaw.[14] Improvements in *blasting apparatus* were disclosed by VanDenburgh,[15,20] Powell,[16] Hollingsworth,[17] Pletcher,[18] Garver,[19] Luce,[21] Stokes,[22] Pollard,[23] and Kriz.[24]

A *wet abrasive dispenser* was patented by Hall;[25] a device for mixing abrasive powder with a carrier gas was claimed by Black;[26] and the use of an *abrasive made from aluminum alloys* for blasting light metals was the subject of a patent issued to Bischoff & Haberlin.[27]

Pickling

Developments in this phase of the art during 1956 were of interest, if not of great importance. Treatments of this type for ensuring adhesion of subsequent electrodeposits will be reviewed in the section on plating, the following paragraphs being reserved for *scale removal* methods.

Continuing the trend of recent years, the patent pages have been more productive than the technical literature. Pickling *processes for copper and its alloys* were reviewed by Fishlock,[28] while methods for *fire scale on sterling silver* were described by Mohrnheim.[29] In the only other article, Ride detailed the results of his study of thirteen nitrogen-containing *organic inhibitors* in sulfuric acid pickles.[30]

Procedures patented during the year included the use of a fibrous material and a gelling agent in conjunction with *hydrochloric acid,* claimed by Cardwell & Eilers;[31] the removal of mould contaminants from *magnesium castings* in fluoride baths, reported by Higgins;[32] a solution of *hot sulfuric and nitric acids,* disclosed by Hahn for *stainless steel*;[33] removal of oxide from *titanium* by hot concentrated muriatic acid, claimed by Hands;[34] and a *fused salt bath* patented by Spence.[35] Other fused salt baths have been noted in the previous section on cleaning.

Novel processes disclosed in the patent grants were for *spray pickling iron* using a conveyor of a noble metal, which is slightly dissolved in the acid and deposited on the iron, according to Rodman;[36] a brush type *electropickling method,* claimed by Kreml, with the use of phosphoric acid and alternating current;[37] and a process using soluble *auxiliary anodes* on a rack which, according to Boguski,[38] are maintained at sufficient polarity (negative) in the pickling tank prior to plating so that they do not dissolve.

Among improvements in pickling apparatus were patents granted to Hampton for a *bar and tube machine*;[39] a unit for *continuous strip pickling* claimed by Rendel;[40] and *drum type picklers* to Ruthner,[41-2] of which one machine was to be employed for coiled metal strips.

Polishing

MECHANICAL:

One of the more gratifying aspects of this phase of finishing has been the regular yearly increase in the amount of information disclosed in the literature. The

past year has been no exception since, in addition to the usual numerous patents granted on polishing and buffing wheels, and on belt finishing inventions, more than the usual number of articles have been published in the trade and technical literature. Of these, the most noteworthy from a scientific standpoint was an investigation of the *structure and depth of the deformed layer* produced on 70:30 brass, to establish methods of *producing surfaces free from serious strains*, reported by Samuels.[43] On the practical side, Doyle[44] was responsible for a very complete description of the various *types of buffs* employed, their construction and application and cost factors involved in their selection, while *abrasive belt techniques* were covered in articles by Redmond,[45] Seward,[46] and Perrett.[47] Polishing methods for *stainless steel* were the subject of papers by two authors, McFee[48] and Huston,[49] and one article by Malz[50] detailed the *finishing of drawn aluminum bodies* using belts, abrasive wheels and buffs.

Among the patents, unusual methods included a machine in which *parts are immersed in a container of abrasive* while both parts and container are driven at different speeds, disclosed by Sleeper.[51] Other patents consisted of a *liquid buffing compound applicator* claimed by Andersen;[52] a *liquid buffing composition* patented by Candee & Doughty;[53] a *polishing material* consisting of vitreous silica and a rare earth oxide claimed by Harman & Rose;[54] and *buffing machines*, which were disclosed by Lane,[55] and by Belejack & Feingold.[56]

Almost two dozen patents were issued during the year on buffing wheels, wire brushes, coated abrasive wheels, belt polishing devices and similar equipment. Because of space limitations, these will not be included in this report but the reader, if interested, can find descriptions in the patent section of METAL FINISHING published each month.

CHEMICAL AND ELECTROLYTIC:

The literature on chemical polishing, or bright dipping as it is more commonly termed, was more meager than during recent years and, what there was, dealt mainly with aluminum. A review of industrial *chemical polishing methods* was presented by Brace[57] and four patents were issued on solution formulas; to Cohn for specified amounts of *phosphoric acid, nitric acid and water*,[58] to McGraw on the addition of 1-3% *graphite* to a phosphoric acid-peroxide mixture,[59] to Helling, Neunzig, Rolie & Lattey[60] on a *nitric-hydrofluoric acid solution* containing ammonium ions and lead nitrate, and to Neunzig[61] for a similar solution to which *gum arabic or dextrine* is added as an inhibitor.

A number of solutions employed for non-ferrous metals, with and without current, were detailed by Grivel,[62] while Silman limited his discussion to chemical and electrolytic *treatments for aluminum* only.[63] In addition to these two articles, another pair were on the subject of *electrolytic polishing*, consisting of one on the *economics and operation* of the process, expounded by McFee;[64] and a report by Williams & Barrett on the nature of the *film formed on copper*, which was found to be a phosphate of copper by electron diffraction examination.[65]

Among the patents worthy of mention were a number of new electrolytes for electropolishing. Guggenberger disclosed a *sulfuric-chromic acid bath*[66] and Turner a *phosphoric-sulfuric acid solution* containing water and an ester of a polyhydric alcohol,[67] both solutions specifically for *aluminum*. An acid solution of alkylene polyamine carboxylic acid salt was claimed for *copper* by Bersworth, Atwood & Bicknell.[68] For *iron, aluminum and nickel*, Smith claimed a phosphoric-sulfuric acid bath containing hydroxyacetic acid, benzene sulfonic acid and toluene sulfonic acid.[69] Bennert[70] was granted a patent on *burr removal from steel* by anodic treatment in HCl solution, followed by a similar treatment in a mixture of hydrochloric, phosphoric acid and water to remove the smut. Another patent was issued to Bo-Shin Ro[71] for a nitric-hydrofluoric acid bath containing dichromate to electropolish *high speed steel*, while Couch & Brenner proposed a *phosphorous acid bath*,[72] and Darmois & Epelboin claimed one of *perchloric acid salt and ethanol*.[73]

Other patents of interest were a new method of electropolishing *elongated tubular interiors*, claimed by Farin, Duddy & Nelson;[74] an apparatus for *polishing one side of a flat metal disc*, disclosed by Kienberger, Greene, Flanders & Flynn;[75] an *adjustable mask* for shielding parts during electropolishing, invented by Jones;[76] and a method proposed by Heyes for *preventing ignition* when using inflammable electrolytes.[77]

BARREL FINISHING:

Most barrel finishing articles may be expected to be on the descriptive side, in view of the necessity for determining processing cycles by trial and error rather than by the application of well-established principles. As a result, a certain amount of duplication cannot be avoided and readers often have to wade through matter quite familiar to them in order to glean a bit of new information. For those who are not expert in the field, however, these articles can be quite valuable. Tumbling barrels, their *selection, advantages, limitations and advantages*, were treated by Mohler,[78] Beaver,[79] Brandt & Stitely,[80] and Mickelson & Olson,[81] the last describing *fixture type barrels* for finishing large parts.

The operational features of the process were not ignored either, being represented by a number of articles. Kohler described *ball burnishing fundamentals*,[82] Kincaid[83] and Polucha[83a] detailed some *operating procedures*, the *selection of media* was the subject of a paper by Nunn,[84] and Brandt discussed the use of the newer types of *fused chips* and *bonded shapes* of aluminum oxide, as well as *chemical additions*.[85]

Patents in this field included a *barrel* in which media is fed in and removed continuously, proposed by Walker;[86] a *drum* for treating parts in bulk, claimed by Tuttle;[87] a *rack type burnishing barrel* disclosed by Benedict;[88] and equipment in which racked work is immersed in a *liquid mass of abrasive material*, invented by Powers.[89] Other patents worthy of mention were on a method involving carburizing and tempering *low carbon steel stampings* prior to barrel finishing, disclosed by Troendly;[90] and a really unusual one in which *polyphase alternating current* is applied, according to Simjian,[91] to a mixture of liquid, abrasive and magnetic particles in which the part is suspended, in order *to create motion* of the particles.

Aluminum — Plating and Anodizing

Anodizing and plating aluminum have been the subjects of more investigations in the last decade than any other phase of finishing and each year, until now, we have been fortunate in obtaining from the laboratories some new basic findings. The productivity, however, seems to be leveling off with more emphasis on practical aspects, as the following developments in the year's literature appear to verify.

Methods of *producing anodic coatings* were reviewed by Pocock[92] and by VandenBerg[93] together with the *characteristics* of the coatings. *Coating properties* were also detailed by Wernick & Pinner[94] who, in another article,[95] also surveyed the subject of *hard anodizing* in complete detail. Other anodizing subjects consisted of a patent on a method of processing a *composite aluminum and steel* part, obtained by Hauseisen,[96] and a description of tested methods for *bulk anodizing* in which Flusin[97] covered both containers and operating procedures. Also, the anodizing process was included by VandenBerg[98] in his review of *commercial finishing treatments* for aluminum. Patents on film production consisted of one to Sanford on an *acid solution* containing an extract from low grade coal, lignite, or peat;[99] and an arrangement for *processing slide fastener elements*, claimed by Bernstiel.[100]

Production of *colored coatings* was the subject of three articles and one patent, the latter to Freedman & Levitin[101] on production of a *photosensitive surface* by forming a silver halide film in situ on the anodized aluminum surface. Bengston[102] reviewed the *factors governing formation* of colored oxide coatings on the light metal; Speiser detailed the *theory and practice of dyeing and sealing*;[103] and Wernick & Pinner surveyed the whole subject of *coloring* the films in one article of their series,[104] and *sealing* them in another.[105] Patents on sealing consisted of the use of a *hot sodium nitrite* solution, claimed by Hampel;[106] and a *hot water sealer* containing a formaldehyde condensation product and nickel or cobalt ions, disclosed by Glauser & Keller.[107]

Plating on aluminum came in for a small share of attention during 1956. Wernick & Pinner detailed *chemical etching* processes for insuring adhesion of deposits,[108] and *anodic oxidation* preparatory treatments;[109] while Beebe, Rothschild & LeBrasse[110] showed that *aluminum-lined steel-backed bearings* could be prepared for the usual zincate dip by first pickling in chromic-sulfuric acid, which doesn't attack the steel.

The patent literature disclosed additional developments. Patrie claimed the production of adherent deposits by employing an *alkaline cyanide zinc solution* containing metals such as copper, silver, and cadmium;[111] Richaud suggested coating with *nickel by chemical deposition*, followed by electrodeposition of lead;[112] and Wasserman[113] prepared aluminum cables for soldering by first applying *electroless nickel*. Other patents included one to Long for a method of coating an *assembly of copper and aluminum* by immersion depositing cadmium on the aluminum area, followed by plating;[114] and another to Combs, Faust & Schaer[115] for a process of *plating bearings* by first dipping in hot weak solution of sulfuric acid and oxalic acid, then copper and tin plating. Before leaving the subject of coatings *on* aluminum, mention should be made of an article by Bailey[116] which described *various finishes*, and another by Pearlstein[117] in which were reported results of *galvanic corrosion tests* on aluminum in contact with other metals, which showed that tin or cadmium plate can be used in contact with anodized aluminum with little or no adverse effect.

For depositing aluminum electrolytically, Murphy & Doumas[118] described a new *organic* bath of aluminum chloride in ether and n-butyl amine which does not require inert atmospheres; Miller & Baker patented another *organic halide* bath;[119] and Owen disclosed a *fused chloride-fluoride* bath which plated steel strip continuously with aluminum at 200-500 amp./sq. ft.[120]

Developments in the production of *hot-dip aluminum* coatings, generally known as "aluminizing," consisted of one article by Hughes[121] on the preparation, properties and uses of steel coated in this manner; and five patents — to Brondyke for the use of a solid *chloride-free flux* of bromide and fluoride;[122] to Hodge[123] for a *flux consisting of alkaline salt* of phosphorus oxyacid with an alkali metal; and to Boegehold[124] for a flux of *potassium and sodium chlorides*, aluminum fluoride and sodium aluminum fluoride. Also the *addition of an alkali metal* to the molten aluminum, claimed by Hodge to eliminate the necessity for a protective atmosphere;[125] and finally a method of *selectively aluminizing*, developed by Rosseau.[126]

Metallic Coatings

One of the natural consequences of the employment of the newer metals in industry is preoccupation with methods for production of adherent deposits on them. *Stainless steel*, the most common of these metals and one of the first to require special handling by the plater, was shown by Morley[127] to be suitably activated by *anodic treatment in sulfuric acid*, followed by cathodic treatment in a solution of sulfuric acid, hydrochloric acid and water. Faust & Beach described a large number of methods for *producing adhesion* of subsequent deposits, on metals such as zirconium, titanium, molybdenum, niobium, and others.[128] They also received a patent on a method for *preparing beryllium*,[129] involving anodic treatment in phosphoric and hydrochloric acids, followed by a dip in 70% nitric acid. Brenner[130] suggested a thin non-continuous *flash brass plate on molybdenum*, which is heated prior to nickel plating in order to promote adhesion; and DeLong[131] patented the method of applying an *immersion copper on magnesium* from a copper sulfate-chromic acid bath, followed by a dip in hydrofluoric acid for adhesion of subsequent nickel plate.

NICKEL:

From the research laboratories emanated the expected quota of scientific reports, of which some were especially interesting from the long-range practical aspects. *Leveling in nickel deposits*, for example, was described by Foulke[132] and investigated by Thomas,[133] who attempted to develop *theories* for the process. Langford[134] detailed the relationship between leveling and the *physical properties* of the deposits and gave an

explanation for the action of some leveling agents in bright nickel baths.

Addition agents were also studied by Newell[135] with respect to their effect on *residual stress* and *hardness* of the deposit, and by Fischer & Ring[136] with respect to their effect on *specular* and *diffuse reflection*. A very comprehensive survey was made by Bellobono.[137] in which he covered the *history of bright nickel* and its evolution and development, followed by a discussion of the *various baths* and the chemical and physical *properties of the deposits*. Only three *bright nickel* processes were patented during the year, which is a record of some sort. These were obtained by Shenk,[138] by Passal for a substituted aromatic and a mercaptan,[139] and by Faust & Safranek for a sulfonated phthalide plus a metal such as zinc, cadmium and thallium.[140] Other work on the solution consisted of a study of the *effects of aluminum*[141] *and manganese*[142] and their removal, by Ewing, Smith & Dow and by Smith & Rowe, respectively; and disclosure of an *alkaline bath* by Moy & DuRose[143] containing a polyalkanoic acid derivative of a polyalkylene amine to complex the metal.

The *permeation of gases* through nickel deposits was investigated by Ewing, Tobin & Foulke,[144] who showed that *electrodeposited nickel has porosity*, in contrast to rolled nickel, which has none. Tobin & Foulke also studied the *effect of corrosion* on gas permeability.[145] Preparation of *spectrochemically pure* nickel deposits was described by Wesley,[146] who used a nickel chloride-boric acid bath. Mohler also suggested this type of bath for *heavy engineering deposits*.[147] In *jet engine design*, there are limitations to the use of nickel deposits, according to Moeller & Snell.[148] However, a patent granted to Rubin[149] claims that *heating of nickel plated carbon steel* at 1450-1650°F. produces an adherent deposit and removes embrittlement, at the same time hardening the steel.

Anodes were covered by one article, by Wesley, on the theoretical aspects of *nickel anode reactions*;[150] and one patent, granted to Pinner & Hoxie[151] on the use of welded *electrolytic nickel sheets*, heat treated to equalize grain growth in and around the weld and to decrease its corrodibility. Bi-polarity of *nickel heating coils* was discussed by Taylor,[152] who suggested a method of baffling them to prevent this effect; and various proposed *substitutes for nickel plating* were considered by Graham[153] who concluded that none had much merit.

The furor over *electroless nickel* has died down but this indicates a stabilization of development rather than abandonment. Only two articles worthy of note appeared in the literature, both in British journals. These articles, by Fishlock[154] and by Aitken,[155] described the *process, properties of the deposit, and applications*. Two *new baths* were patented, one by Girard[156] on a hypophosphite bath containing, sodium acetate, boric acid and ammonium chloride; and the other by Talmey & Gutzeit[157] on the addition of trace amounts of sulfide ions and a sulfide ion controller. Other patents consisted of a *regeneration process* for the bath, claimed by Talmey,[158] and an *activation treatment* for iron, disclosed by Talmey, Metheny & Lee,[159] which consisted of soaking in very weak peroxide prior to nickel coating.

CHROMIUM:

The scientific literature disclosed only one article on chromium solutions, a study by Rousselot[160] of the *influence on covering power* of the five independent variables, chromic acid, sulfate, trivalent chromium, temperature, and mean current density. Patent developments included a *trivalent chromium bath* containing a carboxylic and amine compound, claimed by Icxi;[161] a chromic acid sulfate bath containing acetate, stated by Blaine[162] to produce *bright deposits on antimony, tin, silver and lead*; and four patents on *spray and mist depressants*, granted to Brown and to Millage.[163]

Only one investigation dealt with chromium deposits. Levy & Consolazio[164] examined *hydrogen in chromium plated steel* by means of the mass spectrometer, finding that the gas could not be exhausted completely, although a major portion was liberated after approximately 80 minutes of heating. Internal *plating of gun bores* was thoroughly detailed by Lamb & Young[165] in a valuable article which also listed the requirements of the coating for such drastic service. A description of the procedure for gun bores was also presented by Rosenberg.[166] Other developments consisted of a patent on chromium plating *extrusion dies*, then heating to 2800°F. to form an austenitic chrome steel layer, claimed by Griffiths;[167] and the suggestion by Leithauser[168] that rinsing in pure water containing a small amount of chromic acid after chromium plating improves the *adhesion of subsequent enamel*. It was also suggested by Keller & Zelley[169] that the corrosion resistance of *chromium plated aluminum* could be improved by anodizing for a short period in a very weak solution of chromic acid.

Non-orthodox preparatory treatments for insuring adhesion of deposits on various metals were detailed in both articles and patents. Levy[170] described the development of practical methods for *deposits of chromium on unusual alloys*, while both Missel[171] and Stanley & Brenner[172] restricted themselves to *titanium base metals*, the former suggesting a hydrofluoric acid-dichromate dip, while the latter obtained good results with hydrofluoric-acetic acid solutions. Smart obtained a patent[173] on a method of *plating on antimony* by first immersing in the chromium bath for less than one minute without current prior to plating, while Forestek[174] first applied a *zincate film to aluminum*, then removed it in the chromium plating bath while simultaneously applying the chromium deposit.

COPPER:

Only three articles appeared in the literature during 1956: one by van der Meulen & Lindstrom[175] discussed possible mechanisms involved in the *formation of whiskers* or filaments in the acid copper sulfate bath, and the other two by Okada, Magari & Katsui[176] were electron microscope studies of *copper anodes* electrolyzed in acid sulfate and in cyanide baths. In two patents on production of immersion *copper coatings on silver mirror films* Hilemn[177] claimed the use of copper coated iron powder and copper sulfate on a continuous basis, and Meth[178] simultaneously sprayed a *suspension of metallic dust and solution of copper sulfate* onto the silvered surface.

Brightener investigations were relatively numerous,

judging from the patents granted. For acid baths, Nobel & Ostrow[179] claimed a reaction product of an *amino-thiazole and aldehyde*; Cransberg & Van Oosterhout[180] disclosed the use of a *thiourea compound and a filler*; and other bright processes were claimed by Passal[181] and by Fellows, Hoover & Brown.[182] For brightening *cyanide copper* baths, Ostrow claimed organo-selenium compounds[183] and selenium ion of —2 valence;[184] Overcash & Parks[185] covered zinc, lead, selenium, tartrate and a quaternary amine; Turner disclosed a dithiocarbamate of cadmium, cobalt, nickel, and zinc;[186] and Wernlund employed thiocyanate and potassium antimony tartrate or methylene-bis(naphthalene sulfonic acid).[187]

OTHER METALS:

There were very few developments in the field of cadmium and zinc coating. The former received attention in only one article during the past year, a review of the *practical aspects of cadmium plating* by Kosmos,[188] and the latter was represented only by five patents. Hoffman[189] claimed anisic aldehyde bisulfite, glue, and other materials as a *brightener for cyanide zinc baths*; Turner received a patent[190] for silver as a brightener for same; and Van Houten received one[191] for the use of *selenium and tellurium compounds in acid baths*. In one other patent Hendrich & O'Brien[192] disclosed a process in which *zinc is plated on magnesium* by first applying an immersion zinc deposit from an alkaline bath, then plating in a cyanide bath.

Tin was studied by Mills[193] to determine the influence of process variables on the *reflectivity after flowing the deposit*. An interesting suggestion was offered that the flowing operation might be employed as a stringent *test of operating conditions* in the tin plating bath. One other article described the use of *steel anodes in alkaline tin plating*,[194] and a patent was granted on the use of a stannous fluoride-chloride bath for *steel strip*, in which Swalheim claimed the reduction of oxygen content and sludge formation by bubbling in nitrogen gas.[195] Other patents comprised an *acid tin bath* containing alkali metal fluoride and manganese nitrate, issued to Eckert;[196] and an *immersion tin* process for copper alloys using alkaline stannate and cyanide, granted to Lowenheim & Forman.[197]

Precious metals accounted for practically no activity. A fatty acid-amino acid condensation product was patented by Ostrow & Nobel[198] as a *brightener for gold* plating baths, and antimony and bismuth polyhydroxy aliphatic compounds were claimed for *silver baths* by Greenspan.[199] In the technical literature, Haas[200] suggested a suitable method for *preparing beryllium copper* for silver plating, and Foster & Eddy[201] described the cycle for silver plating *wave-guides*. *Rhodium* was the subject of two rather good articles on *heavy deposits*. Reid[202] considered the experimental and practical aspects, while Wiesner & Meers[203] studied the effects of addition agents, including measurements of stress.

As to other metals, *antimony* was investigated by DuRose[204] as a decorative and protective coating, and an EDTA chelate bath was patented by Smart.[205] *Iron* was also the subject of one paper and one patent. The former consisted of a description by Beach of a *chloride-sulfate bath containing formate*,[206] and the latter was for a chloride-sulfate bath containing *fluoborate*, claimed by Poor.[207] On the subject of *lead plating*, Gianelos[208] patented a fluoborate bath with *aloin and dibenzene sulfonamide* as addition agents, and Smart received a patent on a lead bath,[209] similar to the antimony bath mentioned above. Fused baths produced good deposits of *tungsten*, according to Davis & Gentry[210] who had no success with aqueous or organic baths. Molten salt baths of titanium halide were also claimed by Alpert to produce *immersion deposits of titanium*.[211]

ALLOYS:

Last year we commented on the gratifying interest exhibited in *alloy plating*. That this interest has not slackened will be noted from the number of papers and patents brought forth during the past year, but the surprising thing is the very minor attention paid to the most popular bath, *brass*, which accounted for only two brightener patents to Chester[212-3] The *copper-tin-zinc* bath offered only one item, a patent on a brightener, claimed by Ceresa.[214]

Alloys of the soft metals, lead, tin, zinc, and cadmium, were not neglected, however. Davies[215] studied alloys of 25-50% *tin with cadmium* from both the cyanide-stannate and the fluosilicate solutions, while Lowenheim[216] described the advantages and applications of *tin-zinc* alloys. Among the patents, Roehl[217] claimed a condensation product *addition agent* for the *lead-tin* fluoborate bath, Shockley[218] patented the production of a *tin alloy containing 2-12% antimony and 1-8% copper* from a fluoborate bath, and Hespenheide, Faust & Esarey disclosed processes for production of *copper-lead* alloys from alkaline cyanide-pyrophosphate baths,[219] and from alkaline cyanide baths containing *lead gluconate*.[220]

A number of metals have been codeposited with nickel to form alloys with some interesting characteristics, those of the recently developed *65% tin-35% nickel* mixture being described by Gore & Lowenheim.[221] The *hardness* of this deposit, incidentally, was found by Ramanathan[222] to be 710 Vickers. *Nickel-cobalt* was favored by one patent, to Moline & Clinehens[223] for a bath addition consisting of toluene sulfonamide and the use of superimposed a.c. Porous *nickel-cadmium* deposits were produced and studied by McGraw, Spenard & Faust,[224] and *iron-nickel* alloys suitable for magnetic shielding were deposited by Wolf & McConnell[225] from chloride-sulfate-borate baths.

Chromium was represented by a patent on a *chromium-iron* bath containing urea, claimed by Yoshida;[226] and two to Quaely, for *chromium-nickel* and *chromium-nickel-vanadium* from chromic acid-nickel chloride baths, the deposit containing vanadium having a good black color.[227] Salt[228] presented new information on *iron-zinc*, both the 6% zinc alloy which produced a bright finish, and the 35-55% zinc alloy which had good corrosion protection. A 22 Kt. *gold-silver* alloy was investigated by Harr & Cafferty,[229] and *gold alloys containing molybdenum* and *uranium* were claimed from cyanide solutions by Taormina, Marinaro & Packman.[230]

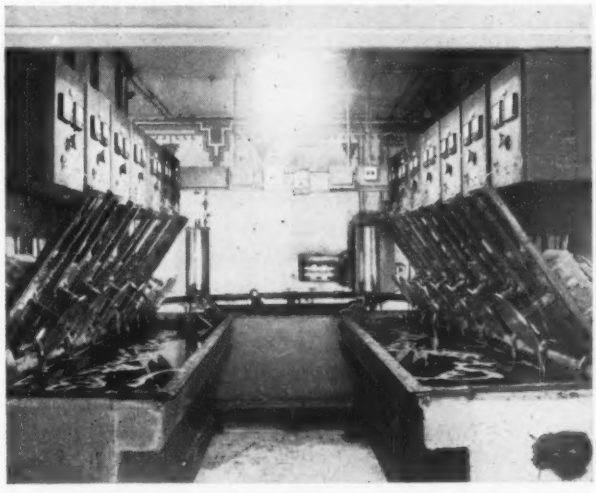
For those interested in the *basic principles* of alloy

deposition and the possible combinations which theoretically can be produced from aqueous solutions, an extensive treatment was presented by Holt.[231]

Electroforming — Metalizing

A general survey of the fundamentals, procedures and practical tips on *applications of electroforming* was prepared by Rubenstein[232] and a similar but somewhat less detailed paper was offered by Carr.[233] Max & Van Houten[234] described the characteristics of *electroformed iron deposits*, and a patent granted to Kosowsky[235] covered *iron record stampers* produced under controlled conditions, as recommended in the previous paper. The production of record stampers was also detailed in a paper by Rumble.[236] The patents ranged widely, Stoddard claiming an *electroformed wave guide* with a smooth, seamless silver lining at least 0.0002″ thick,[237] Lakner disclosed a method of producing a *carbon steel article* by electroforming on a carbide matrix,[238] and Rosenqvist presented a method of continuously producing *tubing*.[239] Other patents consisted of the addition of a small amount of *chloride* to the copper sulfate electroforming bath, granted to Donahue;[240] and an electroforming *apparatus* described by Ross.[241]

Metalizing non-conductors received scant attention during the year, accounting for only one article, that by Narcus[242] who found that *activation of non-conducting surfaces* with a solution of gold chloride rather than the previously suggested paladium chloride permitted quicker coverage of subsequent *electroless nickel* deposits. In the way of patents, some of the claims in this field have always been a source of wonder, such as two of the latest, in which Barrows[243] claimed an electrically *conductive coating* of conductive particles in a non-conducting vehicle, and Lundbye[244] claimed a *silver film on plastic* followed by plating. In other patents Smith & Fitzgerald[245] immersed *glass* in a reducing salt solution, then in precious metal salt solution, repeating as required, with intermediate rinses; Saunders also treated glass[246] by applying acidic *solutions of metal salt containing an electropositive metal*, and solutions of a carbonyl compound and electropositive metal. A patent which falls between the limits of producing conducting films and vacuum metalizing was granted to Lyon,[247] who applied *copper vapor* and then exposed the copper coated surface to *iodine vapor* to form a conducting film.



A high-speed installation for electrofabricating phonograph record matrices. Utilizing cathode rotation, solution circulation and continuous filtration, this plant is capable of plating 0.005″ to 0.007″ of copper per hour.

Vacuum metalizing has, by now, found its niche in the finishing industry as an established production tool and developments during the year have not been of outstanding importance. These were covered in two articles, by Weil[248] and by Seiter;[249] and by a patent on a *lustrous diffused finish* which, according to Fletcher,[250] is produced by applying a base resin containing a large amount of dispersed solid prior to vacuum coating with aluminum. Aside from one patent on a *sight glass* for the vacuum chamber, issued to Avwarter,[251] the remaining patents disclosed *improvements in the method of evaporating* the aluminum. Alexander, Baxter & Boston claimed an *evaporating heater* consisting of a coated carbon core,[252] Patton was granted a patent on the use of a *carbon supporting rod* with a surface of molybdenum or tungsten carbide,[253] and Weinrich[254] received two on the *addition of metals* such as molybdenum and tungsten to the aluminum to retard the spreading speed when heated prior to evaporation.

The principles of *gas plating*, which are now well established, were detailed by Gurnham[255] together with the features and disadvantages. In the only other article noted during the year, Charlton & Davis[256] described a process for *deposition of tungsten* by oxidation-reduction in the vapor phase. The patent literature disclosed much more activity. These were issued to Nack & Whitacre[257-8] for *carbonyl decomposition* processes, to Belitz & Davis[259] for carbonyl *coating steel shafts with molybdenum*, and to sullivan[260] who claimed use of silicon and titanium tetrachloride as *catalysts*.

Combining a casting process with gas plating, by employing the latent heat of the casting to decompose the gaseous metal compound was the subject of three patents, of which two were granted to Toulmin,[261-2] and the other to Belitz & Davis.[263] Other patents were issued to Wainer[264] for *coating molybdenum* with a layer of aluminum, then with an element such as boron, silicon, titanium and zirconium; to Pawlyk[265] for a method of coating interiors of *hollow objects*; and to Nack & Homer[266] on coating *glass fiber*.

Conversion Films — Corrosion Preventives

In the broad area of conversion coatings, phosphates and chromates were predominant as usual, with a scattering of other processes, although *phosphate treatments* were the subject of more technical articles during the year, some scientific and others practical or descriptive. In connection with the former, Doss[267] studied the *corrosion resistance of zinc and manganese phosphate* coatings on steel after heating, finding that the latter lose corrosion resistance at 400-425°F. in the absence of air. Eisler, Doss & McHenry[268] determined the loss of water of hydration from *coatings on steel* by radiometric methods. Gilbert[269] investigated various solutions and *coating formulations*; Spring & Lum[270] examined the influence of various *pretreatments*

on phosphate film formation on steel, concluding that mild alkaline cleaners containing *titanium salts* were best; and Stribley[271] demonstrated the *value of rinse control* in the coating process. In a review of *coating practice* in the U.S.S.R., Holden[272] described a new combined *oxide-phosphate* treatment for iron and steel. *Activation* prior to phosphating, by treatment with *lithium salt* and orthophosphate, was the subject of a patent granted to Condon.[273]

Combination *cleaning and phosphating* formulations were patented by Freud[274] and by Nicholson & Wilkinson.[275] Other *new formulas* contained amine phosphates, which were claimed by Russell[276-8] and E.D.T.A., proposed by Ley, Stenger, Werner & Lampatzer.[279] An *electrolytic process* (cathodic) in a solution of chromic and phosphoric acid was disclosed by Loveland & Prust.[280]

In connection with *chromate processes*, only three articles were noted. Foley[281] described the characteristics and application of the process to *cadmium and zinc*, Pocock dealt with *aluminum*,[282] and Salmon & Ogburn[283] developed a simple *post treatment* for the HAE coating on *magnesium*, consisting of immersion in acid fluoride-dichromate or acid phosphate-dichromate solutions.

Improvements in the art, as disclosed by patent grants, included *solutions for various basis metals*, claimed by Kosmos;[284] by Heller & Spruance;[285] by Nichols, who added nickel sulfate *to retard the etching action*;[286] and by Bleakley,[287] who used layers of *paper impregnated with chromate* between sheets of aluminum to prevent water staining during storage. Somers applied a grease *solvent containing chromic acid*, which was allowed to dry on the parts,[288] and Schuster & Baldi[289-90] disclosed unique methods of forming *coatings in situ* on iron and steel. *Electrolytic chromate* treatments were claimed by Wick,[291] and by Giesker & Britton,[292] the latter for increasing the corrosion resistance of *chromium plated steel*.

Of the less common coatings, *aluminum hydroxide* films on *aluminum* clad metals were claimed by Garner & Graham;[293] *oxalate* films were patented for *chromium alloys* by Gibson;[294] and Henricks[295] suggested a hot acid bath for producing films of *ferrous oxalate and sulfide* on steel. For *silver*, an anti-tarnish wrapper, impregnated with zinc carbonate or borate plus sodium acetate, was disclosed by Gray.[296]

The usual number of patents on *hydrocarbon and other organic* protective films were granted during the year. Vapor phase inhibitors, or *volatile corrosion inhibitors* as they are also known, were patented by Kalinowski,[297] by Senkus,[298] and by Lothringer.[299] Other *organic protectives* were patented by Pfohl & Gregory,[300] Amici,[301] Cardwell & Alderman,[302] Sabol, Fields & Karll,[303] Hiler,[304] Cantrell & Fisher,[305] and Dieman & Ravenscroft,[306]

Testing and Control

Only two papers dealt with *accelerated corrosion tests*, McMaster[307] and Pinner[308] both describing modifications of the *salt spray* procedures. *Thickness testing* received more attention, especially those methods employing *X-rays*. Zemany & Liebhafsky[309] pointed out

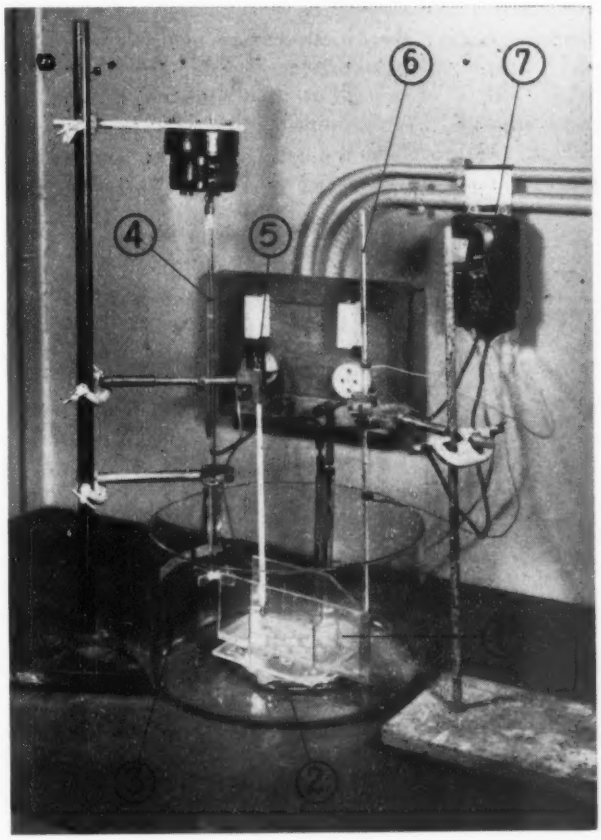
PEI abrasion tester developed at the National Bureau of Standards for determining the abrasion resistance of porcelain enamels and other materials. Instrument provides a rapid, reliable method for testing enamels having different types of finishes, including "orange peel" and wavy surfaces.

that the method has inherent advantages, and both Achey & Serfass[310] and Sellers & Carroll[311] presented new methods employing X-ray *fluorescence*. This system was also employed by Webster[312] for continuously measuring the *tin deposit* on plated strip. Other thickness testing developments consisted of a patent by Brenner & Wagoner[313] on a *thickness gauge* for non-magnetic metallic coatings on non-magnetic metallic bases, and a hydrofluoric acid-cupric chloride *dip test*, described by Wittrock[314] for *aluminum* thickness on coated iron.

Also, in connection with deposits, Comley described the use of microscope and metallographic techniques for investigating *plating troubles* which show up by their effects on the deposit.[315] *Adhesion* was the concern of four authors. Chessin & Poor[316] proposed a test for *hard chromium* deposits which employed small *indentation to a predetermined depth*; Beams[317] described a *spinning rotor procedure*; and Unterweiser[318] survey the whole field, suggesting suitable tests. Another article discussed the difference between *bond and adhesion*.[319] *Porosity* detection by *radiography* was reported on by Ogburn & Hilkert;[320] Kushner offered a paper on the significance and measurement of *stress* in deposits;[321] and McCarthy & Morgia[322] described a *falling abrasive method* for determining *wear resistance* of coatings, employing rotating samples. Patents were granted to Miner for an apparatus for sensing variations in *surface finish*,[323] and to MacKenzie & Matuska[324] for a device for testing the *effectiveness of cleaning solutions*, which involved spraying the cleaners on surfaces treated with a standard soil.

On the subject of *plating solutions*, Mohler[325] reviewed the theory of *throwing power* and practical applications. The construction and operating characteristics of a new *plating cell* for *current density* studies were described by Walton & Gilmont,[326] while a *modified Hull cell* was the subject of a patent issued to Ceresa.[327] *Solution analyses* received extensive treatment in the literature last year, ranging from rough estimation methods[328-9] to polarigraphic analysis of *cadmium* and *zinc cyanide* baths, described by Forsyth[330] and by Collard & Liu[331] respectively. In other papers, Evans reviewed *pH instruments* and their application in metal finishing,[332] while Langford[333] presented an outline of *process control* and the degree to which it needs be applied. A rapid analytical procedure, employing a *metallic manometric apparatus* was described by Muraca,[334] and a procedure for *nickel in bright cadmium baths*, using spectrochemical technique was offered by Friedberg & Levy.[335]

EDTA reagent was employed by Gutman[336] for determination of *copper*, and also by Gehrand[337] for the same metal, the method offering a quicker end point than thiosulfate reagent. Procedures were also reported by Brako[338] for *nickel*, using Murexide indicator; by Branciaroli & Coleman for *fluoride* in chromium baths, using a thorium nitrate titration;[339] by Downey[340] for *traces of zinc* in nickel solutions; and by Langford[341] for *sodium formate* in bright nickel baths.



Apparatus used with the immersion-type Hull Cell (the conventional plating circuit has been eliminated for purposes of simplicity).

1. Immersion-type Hull cell.
2. Heating resistance.
3. Lead anode.
4. Stirring rod.
5. Thermometer.
6. Thermostat controlling the temperature through relay (7).
7. Relay controlling the resistance (2).

Among the miscellaneous analyses reported in the literature, of interest to metal finishers would be two methods involving *ion-exchange*, in *nitric acid-sodium sulfate* baths used for preparing aluminum for spot-welding, developed by Nesh & Haas;[342] and in mixtures of *nitric and hydrofluoric acid*, reported by Wayman.[343] Additional methods connected with aluminum treating baths included a simple method for *bright dips*, proposed by Paulson & Murphy;[344] aluminum in *chromic-phosphoric acid dips*, detailed by Groot, Peekema & Troutner;[345] and various control tests in *color anodizing* presented by Stiller.[346] The analysis of *nitrates in phosphate conversion solutions* was described by Swann & Adams,[347] and determination of various ingredients of *plating room wastes* was reported by Gardner, Muraca & Serfass, including *cyanates*,[348] *nitrate-nitrite*,[349] *orthophosphate*,[350] *sulfate*[351] and *cyanide*.[352]

Waste Treatment

The effect of *plating wastes* on *biological sewage treatment* was described by Tarvin,[353] the generally unhappy consequences of appreciable quantities foreshadowing restrictions to come. Among the methods of *removing cyanide*, Neff[354] discussed control of the *chlorination* treatment; Lakin[355] detailed an improved flow system of treatment of wastes with *sulfur dioxide and chlorine*; and two patents were granted on *electrolytic treatments*, one to Hendel[356] employing 5-7 volts after addition of alkali metal halide to the cyanide waste and adjusting the pH to 8.5; the other to Ricks & Trigg[357] who used *porous carbon anodes* through which oxygen or air is passed into the solution during electrolysis to oxidize the cyanide.

The use of *precipitation and filtration* was treated by Small & Graulich[358] from the standpoint of *economics*, as was an article by Odland & Hesler[359] on recovery of materials by *reconcentration* of reduced volume wastes. Concentration of *rinses* for recovery purposes was also discussed by Neben,[360] and by Weisberg & Quinlan,[361] the latter also employing ion-exchange, a method made use of for *copper, silver, nickel and cyanide*, by Eidsness & Bergman.[362]

Treatment and recovery of *sulfuric acid pickling wastes* was the subject of only one article, by Faust, Orford & Parsons[363] who investigated *neutralization with lime*. It was found that sludges can be concentrated by addition of gypsum or return sludge to the acid before neutralization. Six patents were granted; to Miller[364] on a *pickle recovery* method; to Kidde[365] on a treatment which *recovered iron* and *neutralized acid*; to Mancke[366] for *regeneration* of waste pickle by oxidizing the iron with air at high temperature and pressure to precipitate basic ferric sulfate; to Wunderley[367] on an apparatus and method of *treatment with slag*; and to Rauh[368] on a method in which the pickle is *continuously removed and concentrated* to precipitate ferrous sulfate.

Miscellaneous

A few articles, which might be considered rather theoretical, are worthy of note. Foulke & Kardos[369] prepared data for the purpose of explaining *deposit distribution on microprofiles*, which data were then employed by Kardos for developing a *theory of leveling* action.[370] In a study of *dissolved gases* in plating baths, Tucker & Beuckman[371] confirmed the conditions which will produce *pit-free* deposits. Gabrielson[372] examined the theoretical aspects and principles involved in the *production of smooth, fine-grained deposits*, and Weil & Read concluded their paper on the *structure* of electrodeposited metals, in which the electron microscope was employed.[373] Safranek & Schaer[374] studied the *properties* of nickel, chromium and other metal deposits at *elevated temperature*.

Articles of general interest were quite numerous and varied. Hall[375] reviewed the *technical developments* of the previous year; Promisel[376] and Booth[377] digested government *finishing specifications*; Mohler[378] listed the *characteristics of common electroplates*; a tabulation of similar material listed the factors to be considered in *layout and operation*;[379] and Williams & Zamzow[380] described how excess *job shop costs* were recorded, controlled and reduced. Principles and equipment for *ventilation* of plating tanks were discussed by Mohler[381] and by Arndt.[382] *Filter media* and their properties were detailed by Hood, Lundberg, Shockley & Whitehurst;[383] *maize cellulose* was the subject of an article by Karr;[384] Mohler[385] described the use of *pilot lights* for plating control and offered some shop hints on *plating edges and corners*.[386] A paper by Halliday[387] covered the application of *wetting agents*, while one by Odekerken[388] concerned itself with *pitting*, its causes, and prevention.

Water was the subject of three articles; by Mohler[389] on the characteristics of *controlled rinse tanks*; by Kushner[390] on the *requirements of good rinsing* and the methods of satisfying them; and by Engel[391] on methods of *purifying water supplies* for cleaning and plating. Stephenson[392] suggested an unusual *buffing pretreatment* for diecastings which comprised heat treating the zinc castings for 1 hr. at 410°F. and air cooling, thus insuring improved deposit quality. There was one patent on *coloring*, in which Borghetti & Cavanagh[393] claimed a process for producing *black finishes* on iron and nickel alloys. Other patents included an apparatus, claimed by Miller,[394] for *applying a uniform coating* by spraying the electrolyte onto the surface; the removal of metal cation contaminants from *chromium solutions* by ion exchange, disclosed by Costa;[395] *stripping of gold* using current in an alkaline cyanide-ferrocyanide bath, according to Gagliano;[396] and *removal of silver* from copper with reverse current in a sodium thiosulfate solution, suggested by Black & Walsh[397] for printed circuitry.

Racks and anodes seemed to have preoccupied quite a few inventors. Certa[398] patented a *magnetic* plating rack. Other racks were claimed by Luechauer & Erickson,[399] by Osman,[400] by Reilly & Stoklas;[401] by Shepard & Avellone;[402] and by Luechauer[403-4] for *concave surfaces* with conforming anodes; also by Forestek[405] and by Hill & Knapp,[406] the latter for an *internal anode* of lead coated copper. Schaefer, Pochapsky & Sedusky[407] patented a method of *plating semi-cylindrical bearings*, and an anode electrical connecting device was claimed by Erhardt & Grimes.[408]

Electrical features included a discussion by Stewart[409] of the characteristics of *germanium and silicon rectifiers*, and a description of a new commutator method for periodically changing the direction and magnitude of direct currents, by Ogburn & Salmon.[410] Patents were granted to Sherwood,[411] who claimed to produce bright deposits by superimposing an *asymmetric alternating current*; to Rines[412] who impinged an *electron stream* on the cathode during electrolysis; and to Erhardt[413] for a *current collector* for rotary shafts on plating machines. Rines also claimed the use of *sonic vibrations* at predetermined regions of the cathode.[414]

Mohler had the field of *plating barrels* to himself, as regards the technical literature. In one article he described the different *types of equipment*,[415] and in the other he discussed the calculation of *capacity of hexagonal barrels*.[416] Three patents were issued, however, on *plating cylinder construction*; to Colclesser for a *horizontal cylinder*,[417] to Jackson for a *contact*,[418] and to Luther for a cylinder in which *different lots* could be plated at the same time.[419] Although other patents on *wire plating machines* were granted, the only two developments of more than negligible interest consisted of a method of *simultaneously drawing and plating* wire, invented by Kenmore & Manson,[420] and a *spiral feeding machine* by the same patentees for plating heavy gauge wire.[421]

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112. H. Richaud. U. S. Pat. 2,746,136 (May 22).
113. R. D. Wasserman. U. S. Pat. 2,761,792 (Sept. 4).
114. G. R. Long. U. S. Pat. 2,745,797 (May 15).
115. E. L. Combs, C. L. Faust & G. R. Schaer. U. S. Pat. 2, 766,195 (Oct. 9).
116. J. C. Bailey. Metallurgia, **53**, 57.
117. F. Pearlstein. Met. Fin., **54**, 52 (Apr.).
118. N. F. Murphy & A. C. Doumas. Proc. A.E.S., **43**, 162.
119. M. A. Miller & C. D. Baker. U. S. Pat. 2,763,605 (Sept. 18).
120. C. J. Owen. U. S. Pat. 2,762,764 (Sept. 11).
121. M. L. Hughes. Sheet Met. Ind., **33**, 87.
122. K. J. Brondyke. U. S. Pat. 2,731,362 (Jan. 17).
123. W. Hodge. U. S. Pat. 2,738,289 (Mar. 13).
124. A. L. Boegehold. U. S. Pat. 2,755,542 (July 24).
125. A. W. Hodge. U. S. Pat. 2,774,686 (Dec. 18).
126. L. B. Rosseau. U. S. Pat. 2,751,311 (June 19).
127. E. Morley. Inst. Met. Fin. Bull., **6**, #1, 59.
128. C. L. Faust & J. G. Beach. Plating, **43**, 1134.
129. J. G. Beach & C. L. Faust. U. S. Pat. 2,739,601 (Jan. 3).
130. S. S. Brenner. Plating, **43**, 1143.
131. H. K. DeLong. U. S. Pat. 2,774,683 (Dec. 18).
132. D. G. Foulke. Met. Fin., **54**, 52 (Oct.).
133. J. D. Thomas. Proc. A.E.S., **43**, 60.
134. K. E. Langford. Electropl., **9**, 39, 71.
135. I. L. Newell. Proc. A.E.S., **43**, 101.
136. R. B. Fischer & C. E. Ring, Plating. **43**, 1338.
137. I. R. Bellobono. Met. Fin. Journ. (Br.), **2**, 309, 403.
138. W. J. Shenk, Jr. U. S. Pat. 2,757,133 (July 31).
139. F. Passal. U. S. Pat. 2,737,484 (Mar. 6).
140. C. L. Faust & W. H. Safranek. U. S. Pat. 2,748,068 (May 29).
141. D. T. Ewing, A. J. Smith & W. O. Dow. Proc. A.E.S., **43**, 44.
142. A. J. Smith & R. J. Rowe. Proc. A.E.S., **43**, 46.
143. P. W. Moy & A. H. DuRose. U. S. Pat. 2,773,818 (Dec. 11).
144. D. T. Ewing, J. M. Tobin & D. G. Foulke. J. Electrochem. Soc., **103**, 545, 648.
145. D. G. Foulke & J. M. Tobin. Proc. A.E.S., **43**, 234.
146. W. A. Wesley. J. Electrochem. Soc., **103**, 296.
147. J. B. Mohler. Met. Fin., **54**, 65 (Nov.).
148. R. W. Moeller & W. A. Snell. Proc. A.E.S., **43**, 230.
149. M. M. Rubin. U. S. Pat. 2,731,403 (Jan. 17).
150. W. A. Wesley. T. Inst. Met. Fin., **33**.
151. W. L. Pinner & O. D. Hoxie. U. S. Pat. 2,729,580 (Jan. 3).
152. D. W. Taylor. Met. Fin. Journ. (Br.), **2**, 295.
153. A. K. Graham. Met. Fin., **54**, 65 (Feb.).
154. D. J. Fishlock. Prod. Fin. (Br.), **9**, 61 (Sept.).
155. A. M. Aitken. Met. Fin. Journ. (Br.), **2**, 269.
156. R. J. Girard. U. S. Pat. 2,774,688 (Dec. 18).
157. P. Talmey & G. Gutzeit. U. S. Pat. 2,762,723 (Sept. 11).
158. P. Talmey. U. S. Pat. 2,766,138 (Oct. 9).
159. P. Talmey, D. E. Metheny & W. G. Lee. U. S. Pat. 2,772,183 (Nov. 27).
160. R. H. Rousselot. Met. Fin., **54**, 60 (Aug.).
161. J. J. Iexi. U. S. Pat. 2,748,069 (May 29).
162. T. Blaine. U. S. Pat. 2,745,801 (May 15).
163. H. Brown. U. S. Pat. 2,750,334; 2,750,336 (June 12).
H. Brown & D. R. Millage. U. S. Pat. 2,750,335; 2,750,337 (June 12).
164. C. Levy & G. A. Consolazio. J. Electrochem. Soc., **103**, 624.
165. V. A. Lamb & J. P. Young. Proc. A.E.S., **43**, 260.
166. L. Rosenberg. Iron Age, **178**, 144 (Nov. 15).

167. E. M. Griffiths. U. S. Pat. 2,736,670 (Feb. 28).
168. G. L. Leithauser. Proc. A.E.S., **43**, 32.
169. F. Keller & W. G. Zelley. U. S. Pat. 2,755,242 (July 17).
170. C. Levy. Proc. A.E.S., **43**, 219.
171. L. Missel. Proc. A.E.S., **43**, 17.
172. C. L. Stanley & A. Brenner. Proc. A.E.S., **43**, 123.
173. C. F. Smart. U. S. Pat. 2,764,538 (Sept. 25).
174. C. W. Forestek. U. S. Pat. 2,739,932 (Mar. 27).
175. P. A. van der Meulen & H. V. Lindstrom. J. Electrochem. Soc., **103**, 390.
176. S. Okada, S. Magari & K. Katsui. J. Electrochem. Soc. **103**, 553, 557.
177. H. H. Hilemn. U. S. Pat. 2,759,845 (Aug. 21).
178. M. Meth. U. S. Pat. 2,768,944 (Oct. 30).
179. F. I. Nobel & B. D. Ostrow. U. S. Pat. 2,733,198 (Jan. 31).
180. R. Cransberg & H. A. van Oosterhout. U. S. Pat. 2,742,412-3 (Apr. 17).
181. F. Passal. U. S. Pat. 2,758,076 (Aug. 7).
182. R. A. Fellows, E. W. Hoover & H. Brown. U. S. Pat. 2,738,318 (Mar. 13).
183. B. D. Ostrow. U. S. Pat. 2,732,336 (Jan. 24).
184. B. D. Ostrow. U. S. Pat. 2,770,587 (Nov. 13).
185. D. M. Overcash & R. B. Parks. U. S. Pat. 2,737,485 (Mar. 6).
186. D. R. Turner. U. S. Pat. 2,773,022 (Dec. 4).
187. C. J. Wernlund. U. S. Pat. 2,774,728 (Dec. 18).
188. J. Kosmos. Plating, **43**, 1235.
189. R. A. Hoffman. U. S. Pat. 2,740,754 (Apr. 3).
190. D. R. Turner. U. S. Pat. 2,757,134 (July 31).
191. G. R. Van Houten. U. S. Pat. 2,729,602 (Jan. 3).
192. R. T. Hendrich & D. L. O'Brien, Jr. U. S. Pat. 2,730,490 (Jan. 10).
193. R. Mills. Trans. Inst. Met. Fin., **34**, 8.
194. Anon. Met. Fin., **54**, 64 (Mar.).
195. D. A. Swalheim. U. S. Pat. 2,758,075 (Aug. 7).
196. G. F. Eckert. U. S. Pat. 2,736,692 (Feb. 28).
197. F. A. Lowenheim & H. B. Forman. U. S. Pat. 2,735,788 (Feb. 21).
198. B. D. Ostrow & F. I. Nobel. U. S. Pat. 2,765,269 (Oct. 2).
199. L. Greenspan. U. S. Pat. 2,735,808-9 (Feb. 21).
200. J. Haas. Met. Fin., **54**, 48 (Mar.).
201. L. Foster & F. T. Eddy. Plating, **43**, 623.
202. F. H. Reid. Bull. Inst. Met. Fin., **6**, 107.
203. H. J. Wiesner & H. A. Meers. Plating, **43**, 347.
204. A. H. DuRose. Proc. A.E.S., **43**, 151.
205. C. F. Smart. U. S. Pat. 2,750,333 (June 12).
206. J. G. Beach. Plating, **43**, 616.
207. J. Poor. U. S. Pat. 2,745,800 (May 15).
208. L. Gianelos. U. S. Pat. 2,773,819 (Dec. 11).
209. C. F. Smart. U. S. Pat. 2,751,341 (June 19).
210. G. L. Davis & C. H. Gentry. Metallurgia, **53**, 3.
211. M. B. Alpert. U. S. Pat. 2,734,003 (Feb. 7).
212. A. E. Chester. U. S. Pat. 2,730,492 (Jan. 10).
213. A. E. Chester. U. S. Pat. 2,734,026 (Feb. 7).
214. M. Ceresa. U. S. Pat. 2,739,933 (Mar. 27).
215. A. E. Davies. Inst. Met. Fin. Bull., **6**, #1, 31, 43.
216. F. A. Lowenheim & R. T. Gore. Iron Age, **177**, 92 (Mar. 15).
217. E. J. Roehl. U. S. Pat. 2,734,025 (Feb. 7).
218. Q. O. Shockley. U. S. Pat. 2,744,063 (May 1).
219. W. G. Hespenheide & C. L. Faust. U. S. Pat. 2,739,106 (May 20).
220. W. G. Hespenheide, C. L. Faust & B. J. Esarey. U. S. Pat. 2,763,606 (Sept. 18).
221. R. T. Gore & F. A. Lowenheim. Iron Age, **177**, 59 (May 31).
222. V. R. Ramanathan. Trans. Inst. Met. Fin., **34**, 1.
223. W. E. Moline & R. M. Clinehens. U. S. Pat. 2,730,491 (Jan. 10).
224. L. D. McGraw, J. P. Spenard & C. L. Faust. Proc. A.E.S., **43**, 209.
225. I. W. Wolf & V. P. McConnell. Proc. A.E.S., **43**, 215.
226. T. Yoshida. U. S. Pat. 2,766,196 (Oct. 9).
227. M. F. Quaely. U. S. Pat. 2,739, 108-9 (Mar. 20).
228. F. W. Salt. Electropl., **9**, 3.
229. R. E. Harr & A. G. Cafferty. Proc. A.E.S., **43**, 67.
230. S. C. Taormina, A. T. Marinaro & L. Packman, U. S. Pat. 2,754,258 (July 10).
231. M. L. Holt. Met. Fin., **54**, 48 (Sept.).
232. M. Rubenstein. Met. Fin., **54**, 52 (Feb.); 56 (Mar.); 58 (Apr.).
233. D. S. Carr. Plating, **43**, 1422.
234. A. M. Max & G. R. Van Houten. Proc. A.E.S., **43**, 136.
235. L. K. Kosowsky. U. S. Pat. 2,758,961 (Aug. 14).
236. C. H. Rumble. Trans. Inst. Met. Fin., **33**.
237. W. B. Stoddard, Jr. U. S. Pat. 2,742,930 (Apr. 24).
238. J. F. Lakner. U. S. Pat. 2,758,950 (Aug. 14).
239. G. Rosenqvist. U. S. Pat. 2,756,205 (July 24).
240. D. J. Donahue. U. S. Pat. 2,762,762 (Sept. 11).
241. A. O. Ross. U. S. Pat. 2,771,415 (Nov. 20).
242. H. Narcus. Proc. A.E.S., **43**, 157.
243. W. P. Barrows. U. S. Pat. 2,748,701 (June 5).
244. A. Lundbye. U. S. Pat. 2,768,133 (Oct. 23).
245. E. R. Smith & J. V. Fitzgerald. U. S. Pat. 2,762,714 (Sept. 11).
246. A. E. Saunders. U. S. Pat. 2,762,725-6 (Sept. 11).
247. D. A. Lyon. U. S. Pat. 2,756,165 (July 24).
248. F. C. Weil. Electropl., **9**, 6.
249. J. G. Seiter. Plating, **43**, 484.
250. J. Fletcher. U. S. Pat. 2,767,105 (Oct. 16).
251. M. Avwarter. U. S. Pat. 2,745,131 (May 15).
252. P. Alexander, A. S. Baxter & M. E. Boston. U. S. Pat. 2,756,166 (July 24).
253. P. W. Patton. U. S. Pat. 2,730,986 (Jan. 17).
254. A. R. Weinrich. U. S. Pat. 2,731,365-6 (Jan. 17).
255. C. F. Gurnham. Prod. Fin., **21**, 68 (Nov.); 48 (Dec.).
256. M. G. Charlton & G. L. Davis. Trans. Inst. Met. Fin., **34**, 28.
257. H. R. Nack & J. R. Whitacre. U. S. Pat. 2,731,361 (Jan. 17).
258. H. R. Nack & J. R. Whitacre. U. S. Pat. 2,767,464 (Oct. 23).
259. H. G. Belitz & O. F. Davis. U. S. Pat. 2,763,576 (Sept. 18).
260. M. V. Sullivan. U. S. Pat. 2,759,848 (Aug. 21).
261. H. A. Toulmin, Jr. U. S. Pat. 2,741,216 (Apr. 10).
262. H. A. Toulmin, Jr. U. S. Pat. 2,743,700 (May 1).
263. H. G. Belitz & O. F. Davis. U. S. Pat. 2,742,691 (Apr. 24).
264. E. Wainer. U. S. Pat. 2,772,985 (Dec. 4).
265. P. Pawlyk. U. S. Pat. 2,729,190 (Jan. 3).
266. H. R. Nack & H. J. Homer. U. S. Pat. 2,749,255 (June 5).
267. J. Doss. Organic Fin., **17**, 6 (Aug.).
268. S. L. Eisler, J. Doss & W. D. McHenry. Organic Fin., **17**, 5 (May).
269. L. O. Gilbert. Proc. A.E.S., **43**, 195.
270. S. Spring & J. C. Lum. Organic Fin., **17**, 5 (Feb.).
271. R. B. Stribley. Prod. Fin., **20**, 42 (Aug.).
272. H. A. Holden. Electropl., **9**, 291.
273. J. W. Condon. U. S. Pat. 2,743,205 (Apr. 24).
274. H. M. Freud. U. S. Pat. 2,737,498 (Mar. 6).
275. A. Nicholson & C. F. Wilkinson. U. S. Pat. 2,744,555 (May 8).
276. W. S. Russell. U. S. Pat. 2,766,153-4 (Oct. 9).
277. W. S. Russell. U. S. Pat. 2,769,737 (Nov. 6).
278. W. S. Russell. U. S. Pat. 2,743,204 (Apr. 24).
279. H. Ley, W. Stenger, W. Werner & K. Lampatzer. U. S. Pat. 2,758,949 (Aug. 14).
280. T. A. Loveland, Jr. & A. F. Prust. U. S. Pat. 2,769,774 (Nov. 6).
281. E. F. Foley, Jr. Met. Prog., **69**, 86 (Feb.).
282. W. E. Pocock. Met. Prog., **70**, 97 (Nov.).
283. H. Salmon & F. Ogburn. Plating, **43**, 1241.
284. J. C. Kosmos. U. S. Pat. 2,760,890 (Aug. 28).
285. F. P. Heller & F. P. Spruance, Jr. U. S. Pat. 2,762,731 (Sept. 11).
286. V. R. Nichols. U. S. Pat. 2,760,891 (Aug. 28).
287. W. Y. Bleakley. U. S. Pat. 2,755,167 (July 17).
288. R. I. Somers. U. S. Pat. 2,762,732 (Sept. 11).
289. L. K. Schuster & A. L. Baldi, Jr. U. S. Pat. 2,768,103-4 (Oct. 23).
290. L. K. Schuster & A. L. Baldi, Jr. U. S. Pat. 2,773,623 (Dec. 11).
291. R. M. Wick. U. S. Pat. 2,733,199 (Jan. 31).
292. W. C. Giesker & R. K. Britton. U. S. Pat. 2,746,915 (May 22).
293. P. J. Garner & R. Graham. U. S. Pat. 2,756,162 (July 24).
294. R. C. Gibson. U. S. Pat. 2,774,696 (Dec. 18).
295. J. A. Henricks. U. S. Pat. 2,759,862 (Aug. 21).

296. D. Gray. U. S. Pat. 2,749,210 (June 5).
297. L. W. Kalinowski. U. S. Pat. 2,731,324 (Jan. 17).
298. M. Senkus. U. S. Pat. 2,739,870-2 (Mar. 27).
299. R. L. Lothringer. U. S. Pat. 2,756,120 (July 24).
300. F. W. Pfohl & V. P. Gregory. U. S. Pat. 2,736,658 (Feb. 28).
301. G. Amici. U. S. Pat. 2,743,202 (Apr. 24).
302. P. H. Cardwell & E. N. Alderman, Jr. U. S. Pat. 2,745,809 (May 15).
303. A. R. Sabol, E. K. Fields & R. E. Karl. U. S. Pat. 2,749,311 (June 5).
304. M. J. Hiler. U. S. Pat. 2,756,156 (July 24).
305. T. L. Cantrell & E. E. Fisher. U. S. Pat. 2,763,614 (Sept. 18).
306. E. A. Dieman & P. H. Ravenscroft. U. S. Pat. 2,771,371 (Nov. 20).
307. W. D. McMaster. Met. Fin., **54**, 48 (Nov.).
308. W. L. Pinner. Proc. A.E.S., **43**, 50.
309. P. D. Zemany & H. A. Liebhafsky. J. Electrochem. Soc., **103**, 157.
310. F. A. Achey & E. J. Serfass. Proc. A.E.S., **43**, 41.
311. W. W. Sellers, Jr. & K. G. Carroll. Proc. A.E.S., **43**, 97.
312. R. R. Webster. U. S. Pat. 2,763,784 (Sept. 18).
313. A. Brenner & B. J. Wagoner. U. S. Pat. 2,751,552 (June 19).
314. H. J. Wittrock. Iron Age, **177**, 102 (Feb. 16).
315. A. Comley. Electropl., **9**, 355.
316. H. Chessin & J. G. Poor. Plating, **43**, 913.
317. J. W. Beams. Proc. A.E.S., **43**, 211.
318. P. M. Unterweiser. Iron Age, **178**, 123 (Oct. 18).
319. Anon. Met. Fin., **54**, 70 (Oct.).
320. F. Ogburn & M. Hilkert. Proc. A.E.S., **43**, 256.
321. J. B. Kushner. Met. Fin., **54**, 48 (Apr.); 58 (May).
322. J. McCarthy & J. Morgia. Plating, **43**, 1248.
323. P. T. Miner. U. S. Pat. 2,733,598 (Feb. 7).
324. W. E. MacKenzie & S. A. Matuska. U. S. Pat. 2,729,098 (Jan. 3).
325. J. B. Mohler. Met. Fin., **54**, 53 (Jan.).
326. R. F. Walton & R. Gilmont. Proc. A.E.S., **43**, 239.
327. M. Ceresa. U. S. Pat. 2,760,928 (Aug. 28).
328. Anon. Met. Fin., **54**, 60 (Jan.).
329. Anon. Met. Fin., **54**, 61 (July).
330. G. T. Forsyth. Proc. A.E.S., **43**, 91.
331. T. H. Collard, Jr. & D. K. Liu. Proc. A.E.S., **43**, 56.
332. R. S. Evans. Met. Fin. Journ. (Br.), **2**, 79.
333. K. E. Langford. Electropl., **9**, 177.
334. R. F. Muraca. Proc. A.E.S., **43**, 223.
335. H. R. Friedberg & M. L. Levy. Proc. A.E.S., **43**, 94.
336. F. W. Gutman. Plating, **43**, 345.
337. C. E. Gehrand. Plating, **43**, 747.
338. F. Brako. Met. Fin., **54**, 61 (Sept.).
339. J. P. Branciaroli & J. G. Coleman. Anal. Chem., **28**, 803.
340. T. A. Downey. Plating, **43**, 1335.
341. K. E. Langford. Electropl., **9**, 293.
342. F. Nesh & E. C. Haas. Anal. Chem., **28**, 2034.
343. D. H. Wayman. Anal. Chem., **28**, 865.
344. R. V. Paulson & J. F. Murphy. Anal. Chem., **28**, 1182.
345. C. Groot, R. M. Peekema & V. H. Troutner. Anal. Chem., **28**, 1571.
346. F. P. Stiller. Plating, **43**, 1419.
347. M. H. Swann & M. L. Adams. Anal. Chem, **28**, 1630.
348. D. G. Gardner, R. F. Muraca & E. J. Serfass. Plating, **43**, 743.
349. E. J. Serfass & R. F. Muraca. Plating, **43**, 233.
350. E. J. Serfass & R. F. Muraca. Plating, **43**, 356.
351. E. J. Serfass & R. F. Muraca. Plating, **43**, 500.
352. E. J. Serfass & R. F. Muraca. Plating, **43**, 1027.
353. D. Tarvin. Sewage & Ind. Wastes, **28**, 1371.
354. F. L. Neff. Plating, **43**, 1008.
355. J. Lakin. Electropl., **9**, 221.
356. F. J. Hendel. U. S. Pat. 2,737,298 (Mar. 6).
357. H. E. Ricks & W. M. Trigg. U. S. Pat. 2,773,025 (Dec. 4).
358. H. M. Small & W. C. Graulich. Plating, **43**, 1018.
359. K. Odland & J. C. Hesler. Plating, **43**, 1022.
360. E. W. Neben. Prod. Fin., **21**, 36 (Nov.).
361. L. Weisberg & E. J. Quinlan. Sewage & Ind. Wastes, **28**, 998.
362. F. A. Eidsness & P. A. Bergman. Plating, **43**, 1005.
363. S. D. Faust, H. E. Orford & W. A. Parsons. Sewage & Ind. Wastes, **28**, 872.
364. C. O. Miller. U. S. Pat. 2,769,735 (Nov. 6).
365. G. E. Kidde. U. S. Pat. 2,769,689 (Nov. 6).
366. E. B. Mancke. U. S. Pat. 2,739,040 (Mar. 20).
367. J. M. Wunderley. U. S. Pat. 2,746,919-20 (May 22).
368. C. A. Rauh. U. S. Pat. 2,741,250 (Apr. 10).
369. D. G. Foulke & O. Kardos. Proc. A.E.S., **43**, 172.
370. O. Kardos. Proc. A.E.S., **43**, 181.
371. W. M. Tucker & F. O. Beuckman. Proc. A.E.S., **43**, 118.
372. G. Gabrielson. Met. Fin., **54**, 52 (Nov.).
373. R. Weil & H. J. Read. Met. Fin., **54**, 56 (Jan.).
374. W. H. Safranek & G. R. Schaer. Proc. A.E.S., **43**, 105.
375. N. Hall. Met. Fin., **54**, 43 (Jan.).
376. N. E. Promisel. Plating, **43**, 628.
377. S. F. Booth. Plating, **43**, 490.
378. J. B. Mohler. Mater. & Meth., **44**, 117 (July).
379. Anon. Iron Age, **177**, 99 (June 28).
380. K. K. Williams & C. H. Zamzow, Jr. Met. Fin., **54**, 51 (Mar.).
381. J. B. Mohler. Met. Fin., **54**, 77 (June); 57 (July).
382. F. W. Arndt. Proc. A.E.S., **43**, 70.
383. J. M. Hood, E. Lundberg, O. O. Shockley & M. L. Whitehurst. Proc. A.E.S., **43**, 22.
384. W. Karr. Met. Fin., **54**, 56 (May).
385. J. B. Mohler. Met. Fin., **54**, 60 (Apr.).
386. J. B. Mohler. Met. Fin., **54**, 65 (Sept.).
387. W. M. Halliday. Prod. Fin. (Br.), **9**, 50 (Mar.).
388. J. M. Odekerken. Met. Ind., **89**, 187.
389. J. B. Mohler. Plating, **43**, 732.
390. J. B. Kushner. Electropl., **9**, 44.
391. E. Engel. Prod. Fin., **20**, 38 (Jan.).
392. W. G. Stephenson, Jr. Prod. Fin., **20**, 28 (Jan.).
393. P. Borghetti & W. R. Cavanagh. U. S. Pat. 2,762,733 (Sept. 11).
394. R. A. Miller. U. S. Pat. 2,750,332 (June 12).
395. R. L. Costa. U. S. Pat. 2,733,204 (Jan. 31).
396. F. P. Gagliano. U. S. Pat. 2,735,810 (Feb. 21).
397. O. D. Black & R. M. Walsh. U. S. Pat. 2,758,074 (Aug. 7).
398. A. J. Certa. U. S. Pat. 2,766,194 (Oct. 9).
399. H. C. Luechauer & A. F. Erickson. U. S. Pat. 2,739,117 (Mar. 20).
400. M. G. Osman. U. S. Pat. 2,751,345 (June 19).
401. A. F. Reilly & J. R. Stoklas, Jr. U. S. Pat. 2,734,859 (Feb. 14).
402. G. A. Shepard & R. C. Avellone. U. S. Pat. 2,760,929 (Aug. 28).
403. H. C. Luechauer. U. S. Pat. 2,758,962 (Aug. 14).
404. H. C. Luechauer. U. S. Pat. 2,761,831 (Sept. 4).
405. C. W. Forestek. U. S. Pat. 2,739,937 (Mar. 27).
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Automatic Plating of Zinc Die Castings

By Ernest W. Horvick, *The American Zinc Institute, Inc., New York, N. Y.*

TO satisfy the increasing demands from the automobile and appliance industries for chromium and gold plated zinc die castings, *Lee Silver Service, Inc.* Detroit zinc die casting manufacturer, has established automated electroplating facilities to make possible a daily production rate of 120,000 pieces.

The company supplies industry with a wide assortment of escutcheons, name plates, door handles, horn rings and buttons, control panels and the like. Oldsmobile, Packard, Chevrolet, Chrysler, Norge, Frigidaire, Westinghouse are a few of its customers. For example, the chromium plated zinc die cast door ring used in Bendix washing machines and driers is made by the thousands.

The electroplating problem is, therefore, obvious: To produce economically a high quality, uniform metal finish on thousands of zinc die cast parts varying in size, shape and intricacy. The company has solved this problem by utilizing automatic cleaning and plating lines with some simple but ingenious adaptions for high speed production rates.

Of course, electroplating can be done in 20 gallon crocks if need be — or in any assortment of barrels and tanks. It has been and still is, in many cases, a hand operation. As such, it is time consuming, inefficient and costly. Rejects are frequently high, plating solutions are quickly exhausted, equipment deteriorates at a high rate. The whole process laborwise is drudgery because of heat, humidity, and fatigue from the continual lifting and transferring of plating racks from solution to solution. Though such "hand" electroplating is "skilled" labor, it is difficult to maintain a competent crew at full strength and almost impossible to find apprentices to train. In contrast, the automatic operation is fast, efficient, economical, and clean. Rejects are held to a minimum, equipment and solutions are easily maintained, production is high and labor conditions are excellent.

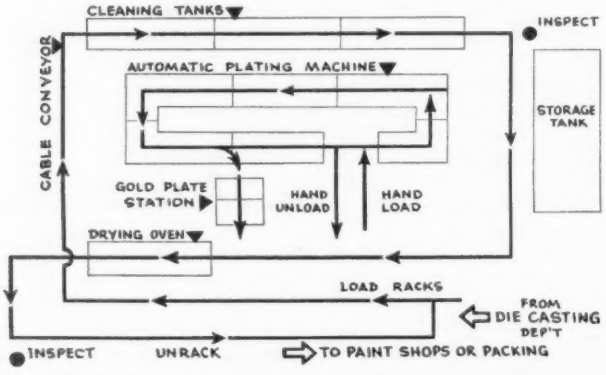

Fig. 1. Flow chart of automatic cleaning and plating operations.

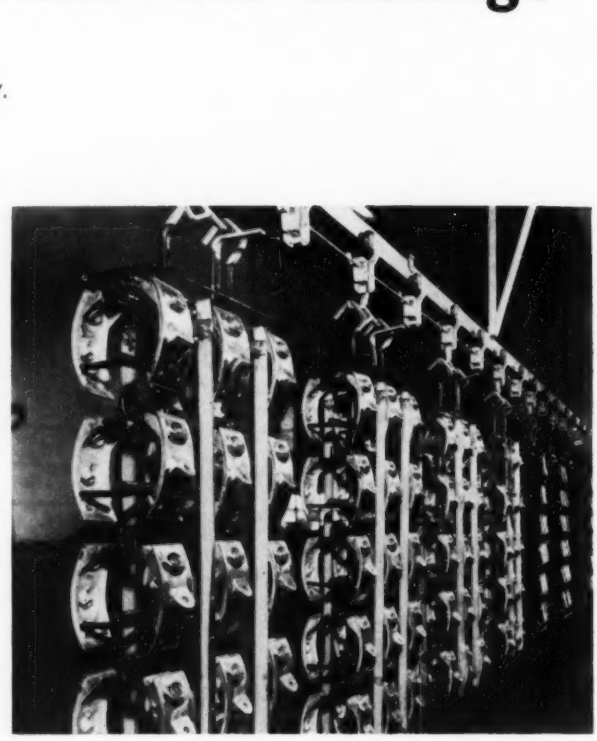

Fig. 2. Racked zinc die cast pieces being conveyed to the cleaning line. These are parts for a heater control panel. Note the specially designed rack has bar anodes (vertical strips between pieces) so placed as to increase the throwing power of the chromium solution and plate hard-to-reach places.

Essentially, the system works this way: Die castings produced and finished in a newly constructed addition to the present plant are brought to the plating line conveyor by hand truck. (Current plans indicate that this process will be automated in the near future as soon as plant construction permits.) They are then placed on the plating racks by hand. Racking the pieces is an especially important operation since each rack is specifically designed to accommodate a particular job. Much of the efficiency of the whole system together with control of the final plate depends on such proper rack design.

The racks are placed on a cable type variable speed conveyor and taken, at 2-6 ft. per minute, to a long narrow series of cleaning tanks placed along one wall of the plating room.

The proper cleaning of each die casting of grit and grime left on from the compounds used in the final finishing and buffing operations is a very important part of the plating cycle and to it may be attributed much of Lee's success in solving the die casting plating problems.

The freshly buffed die castings are sprayed with a mineral spirits product to keep the buffing compound from hardening and to provide an oil film between the base metal and the soil. The presence of this oil interface greatly aids the subsequent removal of soil in the cleaning operation.

The pre-cleaning line is a series of tanks some 95 ft. in length, through which the racks are processed

by the plating conveyor. In the first 30 ft. the parts are immersed in a soak cleaner solution at a temperature of from 180°-200°F. This effectively removes the grit bearing mineral spirits. As the racks are lifted out of solution to proceed to the next tank, they are sprayed with a light mist of soak solution. They are then dipped once again and soaked in an alkaline bath for another 30 ft. They are then sprayed for 25 ft. with a special cleaner at a temperature of 150°., using a power washing machine with a nozzle capacity of two gallons per minute. Final rinse is with city water for ten feet of line length.

After the final water rinse, each rack and each piece on it is inspected before being conveyed to the electroplating line. Transfer from the cleaning and inspection line to the full automatic plating machine is done by hand. The conveyor from the cleaning tank actually continues in a line parallel to and past the automatic plating machine and then to the drying oven. Transfer from the cleaning line to the plating machine is done at the load and unload station. Here are also located the controls for the entire system, together with a test panel indicating the output of the rectifiers at various points in the line. At the transfer point or load station, the clean racks are picked off the cleaning line and hooked onto the plating conveyor and the racks of plated parts are taken from the unload station of the full automatic and returned to the plant conveyor to be borne this time to the drying ovens. The machine length is 70 feet. Total plant conveyor length is 640 feet.

The full automatic plating machine is hydraulically driven and its operation is controlled by simple adjustments of the hydraulic valves. The work carriers ride directly on a one piece cathode rail which acts as a support and conductor. Where transfers are required, a section of the rail is hydraulically lifted, raising the work from the tank, the work carrier moved by the hydraulic pusher mechanism and the work lowered into the next tank. The work carriers are advanced within the tanks when the superstructure is in the down position and the transfers from tank to tank are accomplished by advancements of the work carriers as the super structure is in the up position.

Fig. 3. This special bar makes contact with a heavy copper brush attached directly to those racks which carry parts with hard-to-plate places. Its purpose is to put the anode down into the rack close to these parts so that a special boost will be given to the plating operation just where it is needed most.

Fig. 4. Zinc die cast faucet bases being inspected after exposure to the 95 ft. cleaning cycle. Once past the inspection point, they are conveyed to the plating machine.

The full automatic provides continuous uninterrupted production and exact timing in each tank insuring plating to exact specifications. This is a 21 station machine with the following plating cycle:

No.	*Process*	*Time*	*Rack Spaces*	*Length*
1	Anodic clean	46 sec.	3	62″
2	Warm rinse & spray	10 sec.	1	22″
3	Cold rinse & spray	10 sec.	1	22″
4	Acid dip	10 sec.	1	22″
5	Rinse & spray	10 sec.	1	22″
6	Copper strike	154 sec.	6	132″
7	Copper plate	623 sec.	19	396″
8	Warm rinse & spray	10 sec.	1	22″
9	Cold rinse & spray	10 sec.	1	22″
10	Acid dip	10 sec.	1	22″
11	Rinse & spray	10 sec.	1	22″
12	Nickel spray	730 sec.	22	467″
13	Rinse & spray	10 sec.	1	22″
14	Acid dip	10 sec.	1	22″
15	Rinse & spray	10 sec.	1	22″
16	Chromium plate	118 sec.	5	102″
17	Dragout	10 sec.	1	22″
18	Rinse & spray	10 sec.	1	22″
19	Rinse & spray	10 sec.	1	22″
20	Hot rinse	10 sec.	1	22″
21	Load & unload	82 sec.	4	79″

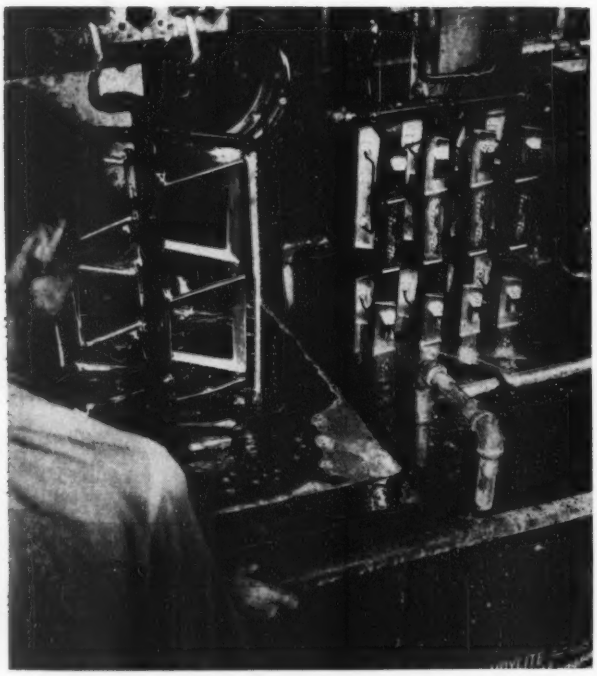

Fig. 5. Typical plating view. At this point these zinc die cast refrigerator parts have been nickel plated and are being rinsed in preparation for the final chrome plate.

There are 21 steps for a normal copper-nickel-chromium plate and 20 for a copper nickel-gold plate. A given plating step will, however, require more or less time than another step. Thus, plating time is controlled by the length of a particular tank and the length itself is indicated by "stations" or rack spaces in the machine. In this way, a water rinse may only require one station, while the bright nickel plate requires 21. Production rate is 100 racks per hour or roughly one rack every 36 seconds.

This plating installation has some unusual features. All rectifiers are connected to a central light panel; when one goes out, the operator knows immediately that this is the case, and which rectifier it is. This saves much inspection time and keeps the plating operation at top efficiency.

There is a special bar located in the chromium-plate section that acts as a current boost. Some pieces have hard-to-plate areas; these are hung on specially designed racks that bring anodically charged sections right down to each piece. This, of course, increases the flow of current precisely at the points where such increase is most effective. These anodically charged sections are attached to a brush arrangement at the top of the rack. When a rack comes into the chromium bath, the copper brush makes contact with the anodically charged bar located there. Current flow is increased and a better final plate results.

There is a special station located just before the chromium plating section of the machine and just after the various rinses that follow the nickel plate. Here racks may be removed and placed in special gold or silver plating solutions. This "gold-plate" station is so situated that it is also near the drying ovens and the conveyor that serves it. Result: Pieces may be gold or silver plated without upsetting the normal plating cycle. Treatment of these special racks is automatic just as it is for racks carrying the more usual parts to be chromium plated. Such pieces are cleaned, inspected, copper and nickel plated with all of the other pieces. Before the final plate, however, they are manually lifted off the plating line, placed in the gold plated bath, timed, rinsed and sent to the drying ovens and final inspection by way of the plan conveyor. In this way, normal plant operations need not be interrupted. Racks to be gold-plated are intermixed with racks to be nickel plated, and the efficiency and uniformity of the whole process is maintained.

The machine is equipped with constant filtration and electropurification. This means that solutions are kept up to strength and the resulting plate is constant and ductile enough for engine turning or engraving.

The nickel solution specified for this operation gives a bright, ductile nickel which eliminates the necessity for color buffing, makes it easy to get a satin finish and cuts down the rejects due to skips during the chromium plating. The chromium bath itself incorporates a spray depressant which eliminates mist and spray and reduces drag-out by 85%. The cost savings here are obvious. The chromium plating tank like the acid dip tanks and the nickel tanks were Koroseal lined to provide the ultimate in tank protection from corrosive solutions.

Copper plating (19 racks spaces) is carried out in a 3000 gallon tank equipped with constant carbon filtration and a filter capacity of 1500 gal./hr. Rectifier is 6 volt/2000 amp. capacity, the current density 20-25 amp./ft. The periodic reverse is at 6:1 ratio. Temperature is held at about 140°F., time of plate is nine minutes, rate of deposition 0.0001″ in 3.5 min.

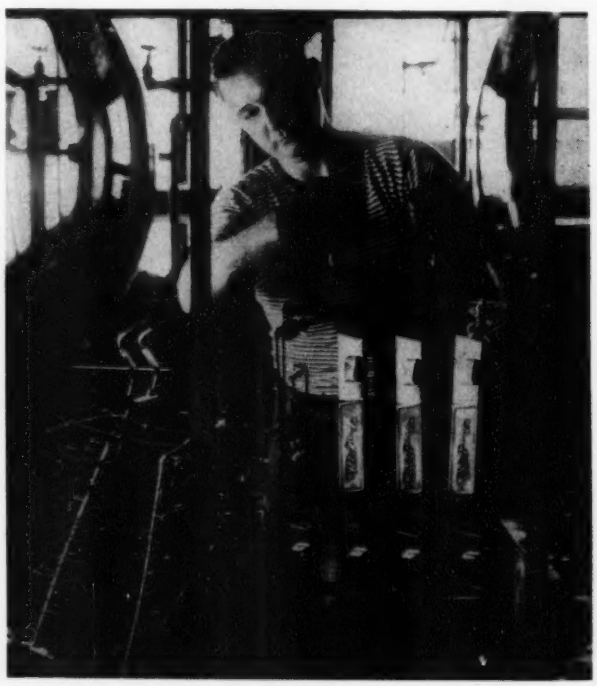

Fig. 6. Gold plating refrigerator parts. At this portion of the cycle, parts can be removed from the line, dipped in the gold plating solutions, rinsed and then placed on the conveyor leading directly to the ovens. This is the only "hand" plating done in the shop.

The anodes are forged balls (as above) and agitation is cathode rod.

The racks then pass through a warm water rinse (80-110°F.) a cold water rinse and a cathodic cleaner. The cathodic cleaning is carried out in a 250 gallon tank at a temperature of 140°F. and 5-6 volts.

After a cold water rinse, a neutralization (150 gal. tank) in 8-10% sulfuric acid, and a cold water rinse, the parts are ready for the bright nickel plate.

The bright nickel plate is a 20 stage operation carried out in a 4000 gallon tank. Filtration here, as in the copper strike and copper-plate, is constant, but the filter size is 2000 gals./hr. Rectifier used here is 6 volts/6000 amps. and the currents density is 60 amp./ft.^{2}. The bath is agitated and the temperature held at 140°F. Anodes are cast electrolytic and rolled and the anode area is made as large as possible. Time of plate is 10.5 minutes at a rate of 0.0001" in 2 minutes. This tank is equipped for continuous purification.

Following the bright nickel plate, the racks pass through a cold water rinse, an acid neutralization and another rinse. At this point, the racks of work to be gold plated are lifted from the machine and the racks to be chromium plated remain on the machine for continued process treatment.

Chromium plating is carried out in five stations in an 800 gallon tank. Temperature is held at 110°F. The rectifier used here is 6 volts/3,000 amp., the current density 120 amp./ft.^{2}.

Following the chromium plate, racks are passed through the chromium drag out, a hot water rinse, and two cold water rinses. They are then inspected and placed on the conveyor line leading to the drier. Note at this point the racks have completed the machine cycle and have returned to the load-unload station.

Once the loaded racks are removed either from the chromium plate and final rinse or the gold plate and final rinse, they must be dried before final inspection. This is accomplished by passing them through a narrow gas drier heated to a temperature of about 400°F. Racks are kept in this 22 ft. drier for 4 minutes and the remaining moisture flashed off with a minimum of stain. They are now ready for inspection, unracking and transfer to the paint shop or directly to shipping.

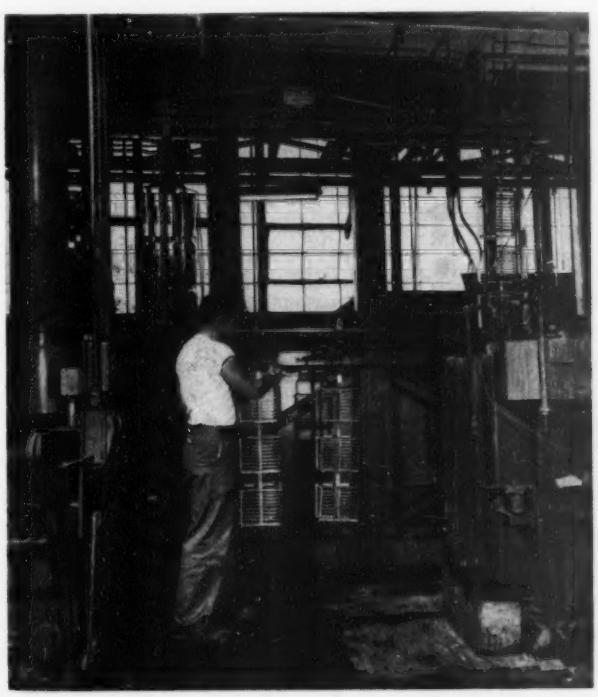

Fig. 7. Load-unload station and control area. These refrigerator parts are being unloaded from the plating cycle. From here they will be carried by conveyor to the drying ovens.

Fig. 8. Parts entering narrow 22 ft. drying oven. Entrance to drier is located next to gold plating station so that those racks that have been especially gold or silver plated can be hooked directly on conveyor at drier entrance.

The automatic equipment requires the following labor: 2 semi-skilled inspectors, one loader (semi-skilled) and one relief man (semi-skilled). In addition, two machine operators are required, two men at the pre-clean operation, one maintenance man and one chemist.

Owners and operators of the company, *Don* and *Lee Radke* are enthusiastic about the benefits of automatic production. According to Lee Radke, the company's president, "Our growth has paralleled our adoption and development of automation. Actually, we purchased automatic equipment ahead of our needs and made our business grow up to its capacity. Our full automatic plating machine engineered to our needs has given us complete plating control and greatly increased production per man hour. Its paradox is that in spite of increased production it brought us such an increase of business that our total employment has steadily increased. Before the purchase of the full automatic, we had 50 employees, now we have four times that number. We are now doing ten times the business we did back in the hand operation days.

We are by no means satisfied, we are constantly looking for further automation and increased production for we realize that only in this way can we keep on lowering costs and meeting the demands of those we serve."

Further modernization and automation of other steps in the production of plated zinc die castings is now the order of the day. Most recent addition: A specially designed buffing and polishing section to prepare the zinc die castings for the final cleaning and plating steps.

Electroless Arsenic-Zinc Alloy

By Harry J. West, Ch.E., *Elkhart, Ind.*

THE method of operation of the electroless arsenic-zinc alloy bath is identical to the equipment and method used for electroless nickel. One can use a plain steel tank instead of porcelain but the life of the solution is not as great. Carbon steel or stainless steel racks are used and the method of heating is by steam coil, electric immersion heater, gas, or a water jacket. The formula consists of:

Sodium hypophosphite	8.0 oz./gal.
Sodium citrate	8.0 "
Zinc sulphate	4.0 "
Arsenic trioxide	4.0 "
Sodium hydroxide	1.0 "
Ammonium hydroxide	8.0 "
Sodium cyanide	8.0 "
Temperature	180-190°F.

The materials are added in the order given above: it is better to add to a warm bath at about 150°F. and, after the chemicals have all been dissolved, then raise to the operational temperature. For a good coating parts should remain in bath for at least fifteen minutes, the thickness will increase with more time in the bath but a maximum is reached in about one hour. The maximum thickness which has been obtained is about 0.0001". As the plating or chemical reduction takes place, additions will have to be made, of course. It has been found that, with the original bath make-up, no chemicals other than ammonium hydroxide, which gradually leaves due to high temperature and chemical reaction, has to be replaced until after eight hours of continuous operation. When the odor of ammonia disappears an addition is due and the operator will notice a slowing down of the reaction at this time or, if new parts are added at this time, no color will be obtained until the ammonia is added. The pH is approximately 11.5.

After eight hours of operation, a suggested method of adding the proper chemicals is as follows: Add one-half of the original make-up after eight hours operation, excluding the ammonia which is a continuous addition. Chemical analysis will control the bath as in any type plating.

Uses

This type of plating can substitute for the zincate method of plating on aluminum. It has been found that any type of aluminum treated with this method subsequently can be plated with almost any other metal without further treatment. Also, all that is required is that the parts be rinsed very well and dipped in 50% muriatic acid before plating to decompose any cyanide which may adhere to the parts. Parts can be treated with this method and can be stored until ready for further processing, such as copper, nickel and chromium plating. A simple dip in concentrated muriatic acid will remove any oxide that might interfere.

The coating of metals such as steel, brass, copper, aluminum and, under certain conditions, stainless steels, has been done. One will find it a very simple and economical method of blackening such metals and eliminates the high temperatures some compounds require for such operations. The coating which is formed in the immersion process may be removed by a dip in hot caustic solution, but is almost impossible to remove with any type of acid.

**Pat. applied for.*

Cleaning of Lead Anodes for Chromium Plating

By L. Missel,

Lockheed Missile Systems Division, Van Nuys, California

THE cleaning of lead anodes used during chromium plating is an extremely vital function frequently neglected by the plater because of the dirty, difficult, and tedious work involved. Presently used methods involve wire brushing directly, or anodic treatment in hot proprietary solutions, usually followed by wire brushing. In either case the work involved is considerable. This cleaning has been achieved easily and effectively, and with no significant dimensional change, by immersion in cold sodium hydroxide—rochelle salt solution.

Whether the plating is controlled by amperage, or even more so when controlled by voltage, it is necessary that the anode surfaces be clean and of continual uniform conductivity to obtain uniform speed, quality and thickness. This is particularly necessary when plating to size or when fixtures are used.

First attempts to clean sections of anodes taken from a sulfate type chromium bath were made with acid solutions containing reducing agents. These solutions were very inadequate. Alkaline solutions of tartrates, citrates and ethylene diamine tetraacetic acid were then tried. All were better than the acid solutions

(*Concluded on page* 58)

Chromium Plating from the Trivalent Bath

By Melvin R. Zell, *Cleveland, Ohio*

SINCE Becquerel first obtained an electrodeposit of chromium from a chromium salt solution in 1843, innumerable attempts have been made to develop a chromium plating bath consisting of an aqueous solution of a chromium salt. All attempts, however, were rewarded with disheartening results and, as everyone knows, the chromic acid process has enjoyed tremendous industrial success for over 30 years.

As recently as 1948, investigators[1] reported poor deposits or none at all from a variety of chromium salt solutions. In the technology of electrowinning, the use of chromium sulfate solutions has proved practicable, using a method developed at the U. S. Bureau of Mines[2] in 1941. These deposits are, of course, entirely grey and lumpy and are of value only to recover metallic chromium from certain ores. In 1950, a patent was granted to Lloyd[3] for the use of certain compounds of sulfur (such as sodium sulfite), in a solution of chromium sulfate and ammonium or alkali metal sulfates, to refine the grain structure of the deposits. This process was still only for electrowinning of the metal.

In 1954, Battelle Memorial Institute[4] received a patent on a bath actually intended for chromium plating. This process uses a solution of chromium sulfate containing a relatively large amount of magnesium sulfate, plus a sulfite as an addition agent. Upon testing this method, this author had difficulty in keeping the salts in solution, and control of the sulfite seemed very critical. Furthermore, this writer hesitates to recommend the use of such easily reducible sulfur compounds because they are eventually reduced to hydrogen sulfide at the cathode and appreciable amounts of sulfur are found in the deposit. Some intermediate compound seems to be formed and the cathode efficiency of the solution drops seriously. Addition of oxidizing agents at this point does not appear to remedy the situation and produces colloidal sulfur from the hydrogen sulfide present.

Researchers have been fascinated with the idea of a trivalent chromium salt bath for several years and solutions of chromium sulfate with ammonium sulfate have been found to be most promising as a starting point. This solution, however, gives extremely poor covering power and deposits are very uneven, cracked, and have a poor, non-metallic grey color. In 1952, it was discovered that the addition of a large quantity of urea to the formulation produced a bright, smooth deposit with fairly good covering power. A patent was issued three years later to Tadashi Yoshida,[5] for the use of this same substance in chromium sulfate baths.

The deposits from this urea-type bath, however, are extremely brittle. Furthermore, they tend to flake off spontaneously even while the work is in the bath. This latter characteristic makes it impossible to use heat treatment after plating, to correct the brittleness and stress of the chromium.

Hundreds of organic and inorganic substances were tried as addition agents or complexing compounds. One purpose was to find an agent to give the beneficial effects of urea without producing cracked deposits. The other was to find an agent to supplement the use of urea, to give more ductile deposits. Many types of compounds containing the amino or similar group showed some promise, but cathode efficiency was low, color of deposit was dark, and ductility usually poor. Finally, a small amount of formamide was added to a solution of chromium and ammonium sulfates* with quite remarkable effects. The deposit was smooth, nearly bright, and very ductile.

Formamide Addition

The first difficulty encountered with the formamide bath was in preventing chromium ammonium sulfate from crystallizing out of solution. High temperature eliminated this condition but caused the formamide to hydrolyze. Formic acid was thus produced, causing dark streaks to appear in the deposit. Since dilute solutions would not perform properly, the most expedient method was to revert to urea. It holds the salts in solution, gives lighter colored deposit, and represses hydrolysis of the formamide. A high concentration of chromium and ammonium sulfate thus can be held in solution at room temperature. There is, unfortunately, some loss of ductility after adding urea to the bath but the deposit does not crack spontaneously, regardless how thick.

Some substance other than urea would possibly be desirable, which could repress hydrolysis of formamide or hold the salts in solution without detracting from the remarkable ductility of the plain formamide bath.

A typical bath would contain the following:

Chromium sulfate	300-400 g./l.
Ammonium sulfate	200-300 "
Urea	300-450 "
Formamide	3- 20 ml./l.

An excess of formamide tends to darken the deposit.

Operating Conditions

The solution is best operated at 80°-100°F. and should not be allowed to exceed 120°F. because there is danger of hydrolyzing the formamide. Should any formic acid accidently be thus produced, it can be destroyed by the addition of small amounts of chromic acid. The formamide should be relatively free from similar compounds. Such a closely related compound

**Pat. applied for.*

as diethyl-formamide will give cracked or brittle deposits. No difficulty was experienced in obtaining a sufficiently pure grade of formamide. Used in such small quantities, its cost has very slight effect on total operation. It was found seldom necessary to make replenishing additions of formamide, even after considerable working of the bath. Chromic sulfate, suspended in small bags near the surface, maintained the concentration of chromium in solution. Small quantities of sulfuric acid are occasionally necessary to compensate for the slight hydrolysis of the urea. Low pH gives slightly lower covering power but better metallic color. No definite pH could be recommended until industrial usage makes an optimum condition apparent.

The problem of anodes has tended to discourage development of chromium salt type baths. Anodes of chromium metal are difficult to fabricate. Furthermore, they easily become passive, which would cause oxidation of the trivalent chromium in solution to chromic acid or chromates. If not passive, they dissolve at much higher efficiency then deposition proceeds at the cathode. This would raise the pH and chromium content of the bath continuously. Metals such as lead, and even platinum, cause some oxidation if used as anodes. Some investigators[5] recommend use of certain alloys which they claim will give a minimum of anodic oxidation. Others[4] prefer the use of certain soluble metals which have no effect on the chromium content. This writer's experience is that a certain drop in efficiency and covering power results when any anode is inserted directly into the plating solution — even before any oxidation can take place.

Best results were obtained with the bath contained in a porous pot which, in turn, was surrounded by an anolyte of dilute sulfuric acid. The anolyte compartment can be closed over the top with only a small vent to allow escape of oxygen. In this manner, almost any conductive material, which resists sulfuric acid with oxygen, can be used for anodes. Lead gave good results. The total electrical resistance of such a diaphragm system is actually less than that occurring when the anode is placed directly into the plating solution. This is probably due to the relatively high viscosity of the bath.

Current density of the process could vary from ten to fifty amperes per square decimeter, which compares favorably to that of the ordinary chromic acid baths. Throwing and covering power also appear to be equal or superior to the latter.

Electrochemists have been intrigued by the possibilities of a chromium salt bath for obvious reasons. The dangerous spray of chromic acid mist can be completely eliminated as well as expensive exhaust systems. Metals which tend to dissolve in chromic acid could probably be plated directly with chromium without any preliminary coating of some noble metal such as copper. The expense of complete treatment of waste solution and rinse water containing chromic acid could be eliminated.

A more exciting aspect of this new method would be in plating for corrosion protection. The chromium deposits from the formamide-type bath have a high resistance to cold hydrochloric acid. This is not just a temporary passivity as often is found with chromium and other metals. The deposit somehow contains some cathodic reduction product of formamide or the other constituents. It is this fact which apparently causes the deposit to behave like a more inactive metal. This inertness will, of course, be very desirable for chromium deposits exposed to somewhat corrosive conditions.

The deposits which the writer produced on iron did not, however protect the basis metal from rusting any better than conventional chromium plating. There is a tremendous possibility even in this case: The formamide-type solution appears to be well suited to the production of chromium alloys. It has been found that small amounts of iron in the bath actually improve brightness of the deposit. Nickel, cadmium, manganese, etc. appear to alloy easily with the chromium deposit when present in low concentration. This project is in a strictly experimental stage but some day may provide the answer for the one-step chromium process. If an alloy of chromium with nickel, for instance, can give a non-permeable coating, no underplate may be required. Certain chromium alloys may also be produced with this bath, having unusual properties for hard-chromium applications.

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CLEANING OF LEAD ANODES

(*Concluded from page* 56)

but, of these, the tartrate solution was most promising and it was put into actual production use.

The anodes are soaked in the following solution at room temperature:

Sodium hydroxide	14 oz./gal.
Rochelle salt	14 oz./gal.

Soaking time varies with surface contamination. However, even heavily coated surfaces can be adequately cleaned in this solution by overnight immersion. Cleaning time can be reduced by increasing the concentration of rochelle salt. After soaking, the anodes are rinsed with water and the loosely adherent residue removed by lightly brushing with a fiber brush and flushing.

Repeated cleaning results in no significant dimensional change. This solution has been in continuous satisfactory use for over three years to maintain cleanliness on anodes used in a large scale chromium plating operation. When cleaning time becomes excessive, the solution can be replenished with rochelle salt. However, a large amount of cleaning can be performed before this becomes necessary. The solution has been held in a lead lined tank. However, there appears to be no reason why it cannot be held in a bare steel or other alkali resistant container.

Acknowledgement

This work was performed at and for *Menasco Manufacturing Co.* of Burbank, Cal., with whose permission this paper is being published.

Science for Electroplaters

20. Polarization — II.

By L. Serota

Metal Deposition

If an e.m.f. is applied to a copper solution with two electrodes connected to a battery source, the potential at which the copper begins to plate out at the cathode is called the deposition potential. This value (E) will compare very closely with the equilibrium potential (E_o) of the metallic copper for that solution concentration and may be represented by the equation $E = E_o + \frac{0.059}{n} \log C$. In the equation, E_o is the standard electrode potential when the concentration, C, of the metal ion is one mole per liter; n is the valence of the ion, which is two for copper in the acid solution; 0.059 is a factor. Since the logarithm of one is zero, the equation when the concentration is one molar becomes $E = E_o$. For reversible electrodes, the metal will plate out (electrolysis begins) from a molar solution when the cathode deposition potential is practically the same as the equilibrium potential. Further, since the log of 10 = 1, ten times the ion concentration will make the potential more positive by 0.059 volt when the valence is one, as in Cu^+ (cuprous), Ag^+, H^+; and more positive by $\frac{0.059}{2}$ volt for a valence of two as in Cu^{++}, Ni^{++}, Zn^{++}.

If, for example, a cadmium sulfate solution is 0.05 molar, then, by substitution, $E = -0.04 + \frac{0.059}{2} \log 0.05 = -0.40 + .0295\ (8.7\text{-}10) = -0.44$ volt. For cadmium to deposit (plate out) from this solution a deposition potential of —0.44 volt will be required instead of the standard cadmium potential of —0.40 volt. The equation indicates that a decrease in the concentration of ions will result in the potential becoming more negative (less positive), and an increase in concentration will cause the deposition potential to become less negative (more positive).

In the case of nickel, which acts as a non-reversible electrode, although the standard potential is —0.23 volt the metal will not deposit on the cathode until a potential of —0.4 volt to —0.5 volt is reached (room temp.), thus making it 0.2 to 0.3 volt more negative than the equilibrium value. To allow for this overvoltage (V) the equation is modified as follows: $E = E_o + \frac{0.059}{n} \log C\text{-}V$. For example, iron has an overvoltage of 0.2 volt (22°C). Since the standard electrode potential is —0.44 volt, the deposition potential from a 0.05 molar solution would be: $E = -0.44 + \frac{0.059}{2} \log 0.05$

$-0.20 = -0.44 - \frac{0.059}{2}\ (8.7\text{-}10)$

$-0.20 = -0.44 - 0.04$

$-0.20 = -0.68$ volt.

Electrolyte with Two or More Ions

If a solution contains two metal ions, deposition will proceed in the order of the rule introduced by Le Blanc, which states: "That kind of ion will be discharged which requires the least expenditure of energy (least negative or more positive potential), taking account of both the equilibrium potential and the overvoltage potential associated with the discharge." For example, the standard potential for copper is + 0.34 volt and that for zinc —0.76 volt. If a mixture of molar solutions, as the sulfates of the two salts, were electrolyzed, the copper ion with the more positive (less negative) potential would be discharged (deposited) first. If the cathode potential, therefore, is kept near to +0.34 volt, practically all of the copper may be deposited and no zinc. Continued electrolysis will deplete (reduce) the copper ion concentration, and the cathode will become more negative until the potential may reach —0.76 volt, at which stage zinc will begin to deposit.

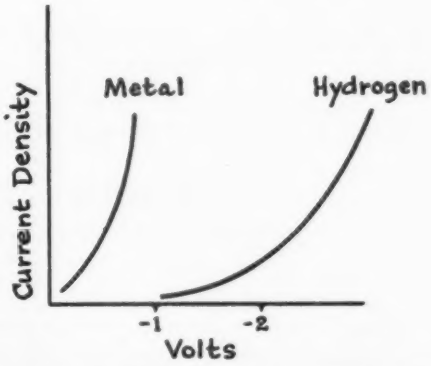


Fig. 90. Overvoltages of hydrogen and of metal, showing conditions for deposition of metal alone.

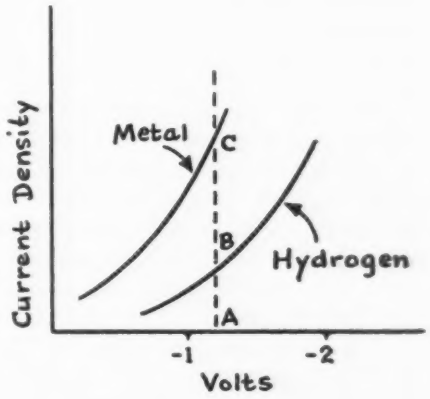


Fig. 91. Overvoltage of hydrogen and of metal, showing conditions for simultaneous deposition of metal and hydrogen.

Hydrogen Overvoltage

In a 0.1 molar sulfuric acid solution containing 1 molar zinc sulfate, the equilibrium (reversible) potential at which zinc will deposit will be approximately —0.76 volt. The potential for hydrogen for this solution, —0.05 volt, though less than the deposition potential of zinc, is not sufficient to release hydrogen because of excessive overvoltage at the zinc cathode, —0.70 volt, or a total potential of —0.76 volt. This is the potential at which both hydrogen and zinc will deposit. Increasing the current density will result in a higher overvoltage for hydrogen. Less hydrogen is therefore liberated, and the current efficiency of the zinc

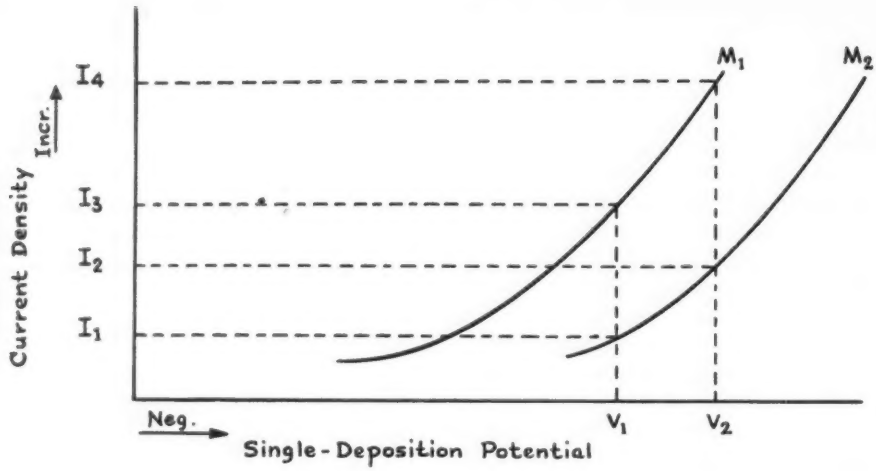


Fig. 92. Single-electrode potentials of metals M_1 and M_2 versus current density in the same type of bath.

deposited will be increased. The reversible potential equation for hydrogen is E — 0.059 log (H^+). The standard potential E_o, it will be recalled, is 0.00, and the valence of hydrogen is one. Since by definition pH = —log (H^+), by substitution, E = —0.059 pH. To allow for the overvoltage (excess potential) the equation is modified to read as follows: E = —0.059 pH-V. The hydrogen overvoltage at a zinc cathode is 0.70 volt, the pH of the solution is 1; substituting. E = —0.059 × 1 — 0.70 = —0.76 volt.

A similar situation occurs in the deposition of nickel from a solution with a pH of 5. The hydrogen overvoltage at a nickel cathode is 0.21 volt (room temp.); hence, E = —0.059 pH-V, or E = —0.059 × 5 — 0.21 = —0.5 volt. This is the potential at which hydrogen should begin to be liberated at the nickel cathode. The standard potential for nickel deposition is —0.23 volt. Overvoltage, however, will increase the discharge (deposition) potential to approximately —0.50 volt. It is evident that nickel deposition will be accompanied by the release of hydrogen. Higher current densities, pH, or temperature will reduce the amount of hydrogen liberated and increase the current efficiency for nickel.

The relationship of hydrogen overvoltage and metal deposition can be effectively represented graphically as in Fig. 90. If the cathode potential for hydrogen is more negative for all current density ranges than the metal in solution, then metal only will deposit. The noble metals, like copper, silver, etc., are so much more positive than hydrogen that the hydrogen ion will not be discharged or, if so, in small quantity — unless, as in Fig. 92, the limiting current density is exceeded. Codeposition of metal and hydrogen will occur if the electrode potential at the cathode is the same for each. In Fig. 91 line CBA indicates the proportions of metal deposited and hydrogen liberated at a specific electrode potential. This curve applies to such metals as nickel, zinc and cadmium.

The liberation of hydrogen and oxygen, together with the deposition of metals in virtually all electrolytic processes, will fall within a standard electrode potential range of two volts, according to R. A. Shaefer and W. King.

The following factors affecting hydrogen overvoltage have been classified in a review by J. O. M. Bockris:

Electrode factors; current density; temperature; change of state; pressure; time, electrode material; surface properties; diffusion through the cathode; shape and curvature on cathode; alloy formation.

Solution factors: foreign salts; solvents; catalytic poisons and activators; gaeseous depolarizers (oxygen); colloids; radiation.

Simultaneous Deposition of Two Metals

Deposition of two metals or the discharge of two ions (cations) at the cathode will occur, as in alloy deposition, if the discharge potentials are close together. For example, since the standard potentials for tin and lead are —0.14 volt and —0.12 volt respectively, the two metals will be codeposited (alloy) from a fluoborate bath. In cases such as the discharge of nickel and hydrogen or zinc and hydrogen, the differences in overvoltage are sufficient to compromise the unequal standard potentials, so that simultaneous deposition of nickel or zinc with hydrogen will occur from slightly acid solutions containing either metal.

Another method of accomplishing codeposition of metals is based upon changes in concentration. This may be done by the addition of potassium (or sodium) cyanide to the solution of salts of the metals. The complex ions that form dissociate to a slight extent, thus reducing the concentration of the simple ions appreciably and bringing the deposition (discharge) potentials of the metals sufficiently close together so that metals will be codeposited (alloy plating). Glasstone lists the deposition potential values for several metals, Table 1, from the simple salt solutions, complex cyanide solutions and hydrogen evolution.

The table shows that copper (+ 0.34 V.) and zinc (— 0.76 V.) cannot be plated together from a solution containing the simple sulfate salts. Copper would plate out first, in fact almost completely before zinc began to deposit, unless the current density was increased considerably. A mixture of these two metals in a complex cyanide bath show discharge potentials which are more negative than those of the simple salts and sufficiently close (—1.0; —1.2) for the metals to plate out together. Variations in the proportion of the cyanides in a plating bath will permit brass deposits of different colors. Fig. 92 shows graphically the codeposition of two metals M_1 and M_2 when the single deposition potentials are about the same. The current densities, however, at such potentials, it will be noted, are different. Hence

TABLE 1 — *Deposition Potentials*

Metal	*Simple Salt Solution*	*Complex Cyanide Solution*	*Hydrogen Evolution*
Silver	+ 0.80 volt	— 0.5 volt	— 0.80 volt
Copper	+ 0.34	— 1.0	— 0.85
Cadmium	— 0.40	— 0.9	— 1.10
Zinc	— 0.76	— 1.2	— 1.3

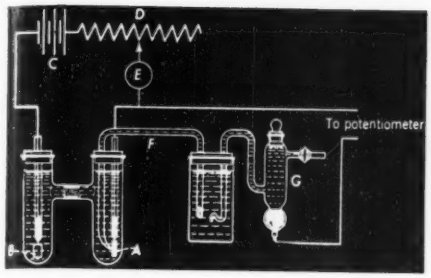


Fig. 93. Measurement of anode or cathode potential.

the amount of each metal deposited at V_1, will be in the ratio of I^3 for M_1 to I_1 for M_2; and at V_2 the proportion will be equivalent to I_4 for M_1 and I_2 for M_2.

The discharge potential for hydrogen in the complex cyanide solutions is more electronegative than the deposition potential of silver and cadmium, but only slightly more electronegative than the cathode potential for zinc. Silver and cadmium will, accordingly, deposit preferentially before hydrogen is liberated up to high current densities, whereas for the zinc cyanide solution some hydrogen will be released together with the deposited metal. The current efficiencies for the deposition of these metals from complex cyanide baths will, therefore, be above 85 per cent. With copper, however, the discharge potential for hydrogen is less electronegative than the deposition potential of copper and, as is to be expected, hydrogen will be liberated with the metal. The effect is a lower cathodic current efficiency (40-60 per cent) for copper deposition from the complex cyanide solution.

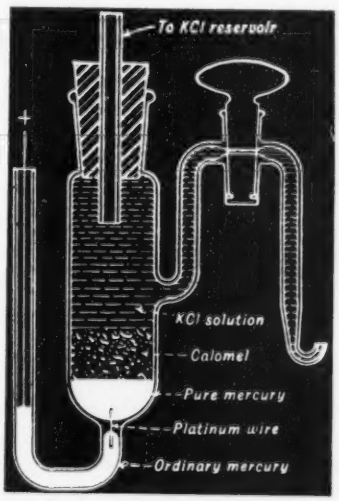


Fig. 94. Type of calomel half-cells.

Polarization Measurement

Measurement of electrode potential requires a method which would distinguish between electrolytic resistivity and electrode polarization. Such a device should be capable of indicating the IR drop (potential) for the solution, which should disappear at the instant when current stops flowing (circuit switch opened), and the rapid but not instantaneous potential drop as the result of polarization. One method for such determinations is based upon the difference in potential of a single electrode when current is flowing and again when current is not flowing, as compared with a reference electrode or half cell. This type of cell, it is assumed, will not polarize when used as a standard for measuring the potential of the electrode. Such an arrangement is shown in Fig. 93. The electrodes, A and B, in the solution comprising an electrolytic cell are connected to a battery or source of potential, C. Included in the circuit is a variable resistance, D, and a milliammeter, E, for current

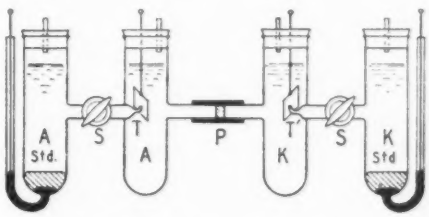


Fig. 95. Basic cell design.

measurements. If the potential of the electrode, A, is to be determined, it is connected through a salt bridge, F, to a reference electrode, G. The potential (e.m.f.) of the cell (electrodes A-G) may then be measured with a potentiometer. The commonly used standard half cell is the calomel electrode, Fig. 94. The tip of the reference electrodes must be as close as possible

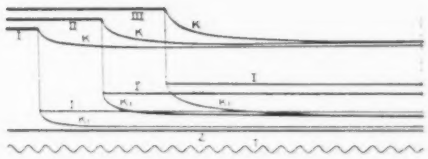


Fig. 96. Overvoltage decay curves for gold cathode at three current densities (I, II, III). K is potential of cathode vs. cathode standard; Ki potential of cathode vs. anode standard; I potential of cathode standard vs. anode standard; Z zero-line of sensitive vibrator; T 120-cycle timing cycle.

to the face of the cathode (or anode) so that the IR drop is reduced and interferences with the flow of current is avoided, a condition which would otherwise affect the polarization at that spot.

Polarization Cells

An improved cell design based upon this principle, Fig. 95 was developed by A. L. Ferguson. The middle compartments A and K contain the anode and cathode respectively, and the end sections consist of the same standard (reference) electrodes A and K with identical potentials. The solution in the cell is the same throughout: An essential feature of this unit is the position of the tip of the reference electrode which, it will be observed, is at the back of the electrode for which polarization measurements is to be made. This differs, the author contends, from other units in which the tip of the reference electrode is in contact in front of the electrode to be measured, thereby eliminating principal sources of error, such as IR drop through the solution and true polarization. The cathode ray oscillograph was found to give the best results for polarization measurements. Results of such determinations are shown for three different current densities in the oscillogram, Fig. 96. The K curves indicate

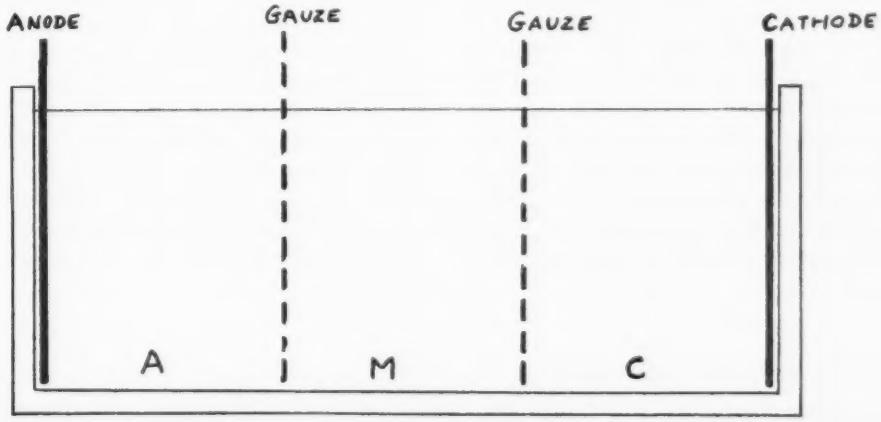


Fig. 97. Haring Cell.

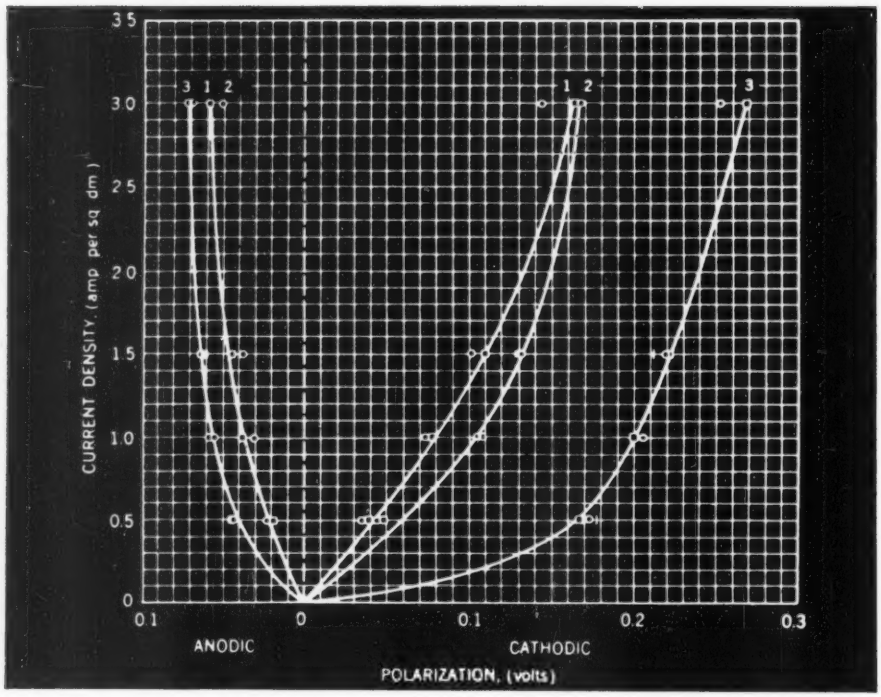


Fig. 98. Anode and cathode polarizations in copper sulfate. Curve 1: Solution A, 1.5N $CuSO_4$ + 1.5N H_2SO_4. Curve 2: Solution A + 0.002 g/l of glue. Curve 3: Solution A + 0.02 g/l of glue. (Derived from H. E. Haring, Trans. Am. Electrochem. Soc., vol. 49, p. 417, 1926).

the decay of potential of the cathode, compared to the cathode standard. Absence of a vertical drop in this curve shows that it is not caused by resistance. For the I curve, the vertical drop represents an IR drop. The Ki curves (potential of cathode and anode standard) consist of the vertical drop or IR drop corresponding to the I curves, with the remaining part of the curves being identical with the K curve.

Haring Cell

A simpler method for measuring both the resistance of the solution and electrode polarization during the process of electrolysis (electrodeposition) is the device developed and reported in 1926 by H. E. Haring and commonly known as the Haring cell. Results are sufficiently accurate to permit industrial application. The cell consists of three equally spaced compartments. The anode and cathode fill the sides of the end spaces, and the middle section is separated by wire gauzes (20 mesh) which permit continuous mixing of the solution, serving thereby as non-polarizeable electrodes. By this arrangement the potential drop in the middle section, labelled M in the diagram (Fig. 97), will be due entirely to the IR drop. Since the anode and cathode spaces will also show an IR drop, a greater value in either A or C may be attributed to polarization. Subtracting the value of the voltage drop corresponding to section M from the potential drop in either A or C, which consists of the IR drop plus anode or cathode polarization, will give the polarization at either electrode.

Anode Polarization = Potential of A — Potential of M

Cathode Polarization = Potential of C — Potential of M

Such measurements of polarization, by the Haring Cell, at either electrode may be made by (a) calomel half cell and potentiometer; (b) gauzes and potentiometer; (c) gauzes and voltmeter. Resistivities of the solutions were also determined by methods b and c. A comparison of data collected on anode and cathode polarization for different current densities in an acid copper sulfate solution with two additional solutions containing different amounts of glue is effectively shown by the graph for Fig. 98. The curves are plotted on the basis of values obtained from the calomel half cell measurements. The values obtained by the other two methods and plotted on the same graph are quite close. Polarization in the three solutions, it will be noticed, shows an increase as the current density is increased.

A modification of the Haring cell was devised by A. L. Ferguson, wherein small end compartments permit the introduction of tips of standard reference electrodes for making contact with the back of the tank electrode. Another electrode cell is adjusted to make contact with the front of the electrode. The unit consists of two standard or reference electrodes for each plate (anode and cathode). With the wire gauzes in position, this arrangement permits three comparative methods of measurement at the same time, namely, the Haring method, and the use of the reference electrodes with the tip in front or in back of the electrode. A method is thus devised for determining the most satisfactory procedure.

An application of this characteristic of polarization in analysis is the polarographic method of analysis of solutions. Methods and procedure have been developed for the rapid determination of the important substances, as well as some of the impurities, in such plating solutions as nickel, silver, copper, brass, chromium. The principle is based upon the polarization of a microelectrode in an electrolytic solution when the reacting ion is oxidized (anion) or reduced (cation). To attain this a microelectrode cathode and a large area anode are employed. Because of the extremely small current used, microamperes, the large area anode will show negligible polarization. For anion analysis the microelectrode is the anode. The dropping mercury electrode is the most effective type. A capillary tube, connected to a mercury reservoir, permits drops to fall through the solution at the rate of about 20 drops per minute (lifetime of about 3 seconds). A layer of mercury in the bottom of the vessel containing the solution or a calomel half-cell may serve as the other (nonpolarized) electrode.

SHOP PROBLEMS

ABRASIVE METHODS SURFACE TREATMENTS CONTROL
ELECTROPLATING CLEANING PICKLING TESTING

METAL FINISHING publishes, each month, a portion of the inquiries answered as a service to subscribers. If any reader disagrees with the answers or knows of better or more information on the problem discussed, the information will be gratefully received and the sender's name will be kept confidential, if desired.

Specifications for Metals and Finishes

Question: My job requires that I maintain an up-to-date record of all specifications available, and a thorough knowledge of different percentages of metals in various alloys. This problem has been magnified in the past year or two, so much so that this request is in order.

1. Is there a method to obtain all available specifications, all Federal specifications, and are other specifications available (for example, Republic Aviation, International Business Machine)?
2. Can you furnish me any information where I can obtain a comprehensive booklet on all types of metals, their numbers, percentages in alloys, etc.?
3. Specification QQ-P-416, Type 2, Class 2, which is supposed to mean cadmium plate .0003 with chromate treatment, does not specify whether it is clear or iridescent finish. This has caused me a great deal of trouble. Some jobs are rejected for wrong color chromate finish, and the old story repeats itself—who pays for it? Can you please explain this problem to me?

N. A.

Answer: Each branch of the Service issues an index to specifications of the branch, which can be obtained by writing to the Superintendent of Documents, Gov't. Printing Office, Washington 25, D. C. Company specifications are not generally available except to their sub-contractors. You would have to get in touch with each company.

The most comprehensive volume on metals, their compositions, and designations, is the Metals Handbook, which is obtainable from the American Society for Metals, 7301 Euclid Ave., Cleveland 3, Ohio. You can write to them for the costs of the Handbook and Supplements.

Specifications calling for chromate finish often do not specify clear or iridescent. Ordinarily, the latter is required, only as visible proof of the chromate treatment. However, this is a matter to be taken up with the customer.

Anode Polarization in Brass Baths

Question: We encounter difficulties operating our brass solution. A load of 45 lbs. work draws initially 300 amps., but within one half hour the amperage drops to about 25 to 50 amps. We surmise this is due to excessive polarization of the anodes.

We should greatly appreciate your kind advice about rectifying this condition; at least about minimizing same.

P. L.

Answer: This condition is commonly eliminated by adding cold-rolled steel sheet anodes equivalent to about 20% of the total anode surface. When the brass anodes polarize, the current passes through the steel until the anode film redissolves. Since the cathode efficiency of a barrel brass is much lower than the anode efficiency, adding steel anodes will not cause depletion of the solution.

A load of 45 lbs. should pull about 125-150 amperes in a regular room temperature brass solution. If a hot, high speed brass solution is being employed, 300 amperes would not be excessive, but sufficient anode surface must be provided to avoid anode polarization.

Finishing Tubular Steel Furniture

Question: We are interested in a chemical blackening process for tubular furniture, and the present plating facilities we have are cyanide-copper, nickel (not bright nickel) and chrome, together with the required acid and alkali cleaners and rinses. The process we are seeking should, if possible, be able to utilize some of these solutions as well as giving a finish, if not rustproof, at least not more likely to corrode than a copper-nickel-chrome finish.

We have further experimented with a bright nickel solution, but have not had much success. Due to the irregular shapes of the articles, we found nickel building up at the ends, and also the brightness not being uniform. We would be pleased if you could supply us with information as to whether manufacturers of tubular steel furniture in the United States are meeting with success in the use of bright nickel on their products, and if so what type of solution, methods and precautions they employ.

E. L. S.

Answer: Chemical blackening processes for steel furniture are not corrosion resistant at all, compared with copper - nickel - chromium plate, and must be protected with an oil, wax, or lacquer. Since you already have the equipment for preparing the metal, a blackening tank equipped with means for maintaining the temperature at about 295 deg. F. would be the only additional requirement.

American manufacturers of tubular steel furniture use various bright nickel plating baths without experiencing any difficulty. Non-uniformity of deposit thickness or lack of brightness may be due to improper racking or contamination of the plating bath. Dull areas may also be due to poor cleaning.

Black Color on Brass

Question: We are manufacturers of small novelties made of brass and are

interested in obtaining a good formula and procedure in getting a black or blue-black finish through the immersion method. We understand there are several formulas and the best one is the ammonia. We would be most appreciative if you can enlighten us on whether or not this is the best method and any additional information you can give us.

B. H. D.

Answer: The blue-black color on brass is produced by the copper carbonate-ammonia process by immersion at 180 degrees or over in the following solution:

Copper carbonate 1 lb.
Ammonia ..... 16 fluid oz.
Water ..... to make 1 gallon

There are a number of proprietary processes which will produce a jet black color. Suppliers will be found in the list on page 553 of the 1956 edition of the METAL FINISHING GUIDEBOOK.

Coatings for Steel

Question: We have been requested to recommend the best finish on steel which will be used under two different conditions. The following are the two conditions:

1. In a baking operation at temperatures up to 350°F.
2. In a humidifying chamber at a temperature of 170°F. at 78% relative humidity and slightly acid.

W. E. L.

Answer: Almost any plated coating on steel will stand up in an oven at temperatures up to 350°F. Nickel would be a good metal since it will not discolor at that temperature.

For high relative humidity and acidic atmosphere we would not recommend any plated coating because of unavoidable porosity. A plastisol coating such as is used for rack coating would be best.

Electroforming

Question: We do quite a bit of electroforming using plastics, aluminum and stainless steel. I have some trouble with blisters on the stainless steel. Can you give me some information on pretreatment of stainless steel for removable mandrels of stainless, also what type is best for mandrels?

C. E. W.

Answer: Ordinarily, it is not necessary to treat stainless steel prior to use as an electroforming mandrel; almost any of the 300 series alloys, containing nickel, will readily air passivate. However, a dip in 25% nitric acid for a few minutes is desirable to clean the surface.

Blisters are often due to the difference in temperature between the stainless steel mandrel and the plating solution. Both should be at about the same temperature.

Chromate Films on Cadmium

Question: I am working with the following chromate dip for cadmium:

sodium bichromate .. 4 oz./gal.
sulfuric acid ..... 15 cc./gal.
water ..... 1 gal.

This is what I am having trouble with. The solution becomes flat and it doesn't function properly after I use it for a while. Can you please suggest any recommendations or possibly supply another formula. I do mostly screws, nuts, etc. on a small scale.

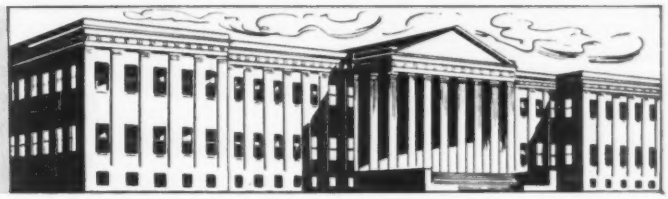
L. R.

Answer: The chromate dip requires replacement at short intervals because it is quite weak to start with. By increasing the dichromate content to about 27 oz./ gal. and the sulfuric acid to 25 cc./gal. longer life will be obtained. However, the color will be darker, almost an olive drab rather than iridescent.

If it is necessary to work with the dilute bath, you can add to the life of the solution by replacing the sulfuric acid which is used up. The pH is maintained at 1.0-3.5 with an electrometric pH tester.

Patents

RECENTLY GRANTED PATENTS IN THE METAL FINISHING FIELD



Metalizing Non-Conductors

U. S. Patent 2,746,886. *May* 22, 1956. *R. B. Belser, assignor to Georgia Tech Research Institute.*

The method of coating a silicious material with metal, comprising cleaning the silicious material to be coated, fusing an indium rich substance containing more than 75% of the metal indium alloyed with a metal of the class of face-centered cubic crystals, and flowing the fused indium rich substance onto the silicious material at a temperature slightly above the point of fusion of said indium rich substance.

Metalizing Non-Conductors

U. S. Patent 2,746,888. *May* 22, 1956. *H. F. Ross, assignor to E. I. du Pont de Nemours & Co.*

A method of forming a titanium coating on the surface of a refractory solid inert body which comprises immersing said solid body in a fused salt bath consisting essentially of a divalent titanium halide and not less than one of the group of halides selected from the group consisting of alkali and alkaline earth metals for a period of time and at a temperature sufficient to deposit a coating of titanium on said body.

Corrosion Prevention of Chromium Plate

U. S. Patent 2,746,915. *May* 22, 1956. *W. C. Giesker and R. K. Britton, assignors to The Autoyre Co., Inc.*

The method of increasing the corrosion resistance of a steel article having a plating of chromium thereon which is normally cathodic to the steel of the article when immersed in a sodium chloride solution, which comprises forming a coating over the chromium plating which is anodic to the steel of the article by connecting the article as a cathode in an aqueous electrolyte consisting essentially of a hexavalent chromium-containing compound, passing an electric current through said electrolyte having a current density of from about .1 to 15 amperes per square foot of cathode, and maintaining the temperature of the electrolyte not in excess of about 200°F.

Pickling Waste Treatment

U. S. Patent 2,746,920. *May* 22, 1956. *J. M. Wunderley.*

In the method of disposing of waste pickle liquor comprising sulphuric acid and ferrous sulphate in aqueous solution, the steps of mixing the liquor with a sufficient quantity of granulated basic ferrous slag to react with and substantially neutralize the acid of the solution, absorbing the solution into the slag during such mixing for reaction therewith and depositing of the reaction products thereon, then air drying the slag to fit the iron of the reaction products therein as substantially water-insoluble iron compounds.

Cleaning Tin and Aluminum

U. S. Patent 2,748,035. *May* 29, 1956. *I. J. Duncan, assignor to Detrex Corp.*

In a method of removing incrustations from a work object having a surface selected from the group including tin, aluminum and their oxides, in which method the object is immersed in a hot, aqueous, strong alkali cleaning solution in the presence of a dissimilar surface selected from the group consisting of tin, aluminum and their oxides, which solution tends to attack the surface of said work object by galvanic corrosive action, the novel step which comprises inhibiting said corrosive action by incorporating about 2% to 8% by weight ferricyanide ions into said solution.

Buffing Wheel

U. S. Patent 2,747,981. *May* 29, 1956. *A. S. Brown and A. M. Brown, assignors to Divine Brothers Co.*

A buff having a relatively high degree of wear resistance, comprising a plurality of plies of woven textile fabric arranged in side by side relation and collectively having an approximately cylindrical peripheral working face, each of said plies of fabric being impregnated throughout substantially its entire mass with a mixture of a substantial quantity of polyethylene glycol having a molecular weight in the neighborhood of 400 and a substantial quantity of polyethylene glycol having a molecular weight in the neighborhood of 6,000, the glycols in the impregnating mixture being in the proportion of not less than one part and not more than two parts of said glycol having a molecular weight in the neighborhood of 6,000 to each one part of said glycol having a molecular weight in the neighborhood of 400.

Bright Nickel Bath

U. S. Patent 2,748,068. *May* 29, 1956. *C. L. Faust and W. H. Safranek, assignors to Rockwell Spring and Axle Co.*

A composition of matter for depositing a bright nickel electroplate which comprises an acidic solution of a major amount of nickel, an organic material selected from the group consisting of sulfonated phthalide and sulfonated naphthalide in an amount equivalent to at least 2 g./l. sulfonated phthalide and from 0.1 to 1.0 g./l. of a metal selected from the group consisting of zinc, cadmium and thallium.

Porcelain Enameling

U. S. Patent 2,748,066. *May* 29, 1956. *I. P. Whitehouse, F. E. Kendall and P. Golar, assignors to Republic Steel Corp.*

The method of producing a tenaciously adhering, uniform and continuous porcelain enamel finish coat on a steel article having a carbon content between about 0.01% and about 0.30% which consists essentially of the steps of uniformly and regularly removing a surface portion of said article equivalent to at least about 0.01 gram per square inch and thereby producing a surface on the article substantially free

of gas-retaining recesses due to excessive pitting, etching or roughness, chemically but non-galvanically applying to said recess-free surface a coating of non-ferrous metal selected from the group consisting of nickel, cobalt, molybdenum and antimony ranging in thickness between about two and about ten millions of an inch, applying porcelain enamel slip substantially free from adherence promoting oxides directly to the resulting coating, and firing said slip and producing said enamel finish coat.

Coating Drum

U. S. Patent 2,748,549. *June* 5, 1956. *J. N. Tuttle, assignor to J. N. Tuttle, Inc.*

In the method of treating a mass of relatively small metallic parts to produce a corrosion-resistant chemical coating, the steps which comprise disposing said parts in an annular chamber of a drum defined by concentric inner and outer foraminous walls, the parts being packed so that they have a slight degree of freedom of movement, but insufficient to undergo tumbling action, thereby insuring a balanced load, immersing said drum and parts into a chemical treating solution reactive with said parts to produce a corrosion-resistant coating, and rotating said drum so as to cause said treating solution to migrate through said foraminous walls and uniformly react with said parts.

Electrically Conductive Coating

U. S. Patent 2,748,701. *June* 5, 1956. *W. P. Barrows.*

An electrically conductive corrosion resistant coating comprising a layer of non-conducting vehicle applied to a metal surface, and a number of conductive particles having a predetermined size greater than the thickness of said nonconducting layer and being randomly distributed and spaced apart from each other to form minute projections extending from the metal surface through the layer to a point above the surface of the layer of non-conducting vehicle.

Wire Plating Machine

U. S. Patent 2,748,784. *June* 5, 1956. *H. Kenmore and W. J. Manson, assignors to National-Standard Co.*

In an apparatus for treating heavy gauge wire which includes means for

suspending and rotating a horizontally extending helix comprising a plurality of coils of wire to continuously move the said helix horizontally, the improvement which comprises a plurality of horizontally arranged juxtapositioned treating baths adapted to surround the suspended portions of a series of the coils of said helix, said juxtapositioned baths having bottom and side walls and being separated from each other by end walls, corresponding sides of said baths being in alignment and opposite sides thereof being substantially parallel, said end walls being secured to the side walls and the bottoms of said baths, each of said end walls having a first side region adjacent the top thereof which is obliquely positioned with respect to at least one of the bottom and the side walls of said baths towards one end of the side walls and each of said end walls having a second side region opposite said first side region which is similarly obliquely positioned in a direction opposite to that of the first side region, said end walls being of substantially uniform thickness throughout and corresponding parts of each of said end walls being substantially parallel.

Trivalent Chromium Bath

U. S. Patent 2,748,069. *May* 29, 1956. *J. J. G. Icxi.*

A chromium electroplating bath of a pH of about 7 consisting of an aqueous solution of at least one complex salt of trivalent chromium corresponding to the formula:

$$Cr\ (Acid)_{\frac{6}{n}} - (Amine)_3$$

wherein "acid" designates at least one organic carboxylic acid radical having less than six carbon atoms, "*n*" designates the number of carboxylic groups in said acid radical, and "amine" designates at least one radical selected from the group consisting of amine and ammonium radicals, said amine radical having at most six carbon atoms.

Buffing Machine

U. S. Patent 2,748,546. *June* 5, 1956. *H. A. Lane, assignor to Midwest Supply and Mfg. Co.*

A machine of the class described comprising a frame, a support arm, a universal pivot connection between said arm and frame, a motion limit-

ing device between said frame and arm effective to limit motion of said arm to a plane passing through the pivot center of said universal pivot connection, means for adjusting said device about the longitudinal axis of said arm passing through said pivot center, a tool spindle on said arm, said motion limiting device comprising a first link pivoted to said arm, a second link pivoted to said first link, and a support adjustably secured to said frame, said second link connected to said support.

Metal Spray Gun

U. S. Patent 2,749,176. *June* 5, 1956. *F. W. M. Steyer, assignor to Arnold Otto Meyer.*

An electro metal spraying pistol for melting the ends of two metal wires in a short circuit arc and spraying the molten metal onto the surface to be treated by means of a compressed air jet, comprising a nozzle head having a discharge mouth at its front end, a conduit for supplying a flow of compressed air to the discharge mouth, feeding and guiding means for continually feeding and guiding the wires through said nozzle head and the discharge mouth, said feeding means including a multiple feeding roller gear arranged at the rear side of said nozzle head, a valve in said conduit, switch means for controlling the flow of current to the pistol, and means for preventing said switch means from switching on the short circuit as long as said valve is closed.

Aluminizing

U. S. Patent 2,751,311. *June* 19, 1956. *L. B. Rosseau, assignor to Ajax Electric Co.*

The method of selectively aluminizing, which comprises maintaining a bath of molten flux, maintaining a body of molten aluminum beneath the flux and in contact therewith to rectify the flux, immersing metal articles to be aluminized beneath the flux, maintaining a second body of molten aluminum beneath the flux, relatively raising the second body of molten aluminum until it surrounds at least a portion of the metallic articles to be aluminized while maintaining the second body of molten aluminum at all times beneath the level of the flux and then relatively lowering the second body of molten aluminum with respect to the metallic articles being coated and reestablishing instantaneous contact of flux with the articles which have been coated.

Anti-Tarnish Wrappers

U. S. Patent 2,749,210. *June* 5, 1956. *D. Gray, assignor to Oneida, Ltd.*

An article of manufacture for protecting silverware from tarnish comprising a fabric impregnated with a salt of zinc, the anion of which is a member of the group consisting of a carbonate and a borate and containing sodium acetate, said impregnated fabric when moistened having a pH from 7.0 to 10.0.

Lead and Lead Alloy Bath

U. S. Patent 2,751,341. *June* 19, 1956. *C. F. Smart, assignor to General Motors Corp.*

An electroplating bath for electrodeposition of lead which consists essentially of an aqueous solution containing at least one anode corrosion promoter of the group consisting of citrates, tartrates and acetates, at least one member of the group of lead compounds consisting of lead oxide, lead acetate, lead chloride, lead fluoborate, and lead sulfate and an alkali metal salt of ethylene diamine tetra acetic acid in an amount sufficient to complex lead in solution.

Chromium Bath

U. S. Patent 2,750,334. *June* 12, 1956. *H. Brown, assignor to The Udylite Research Corp.*

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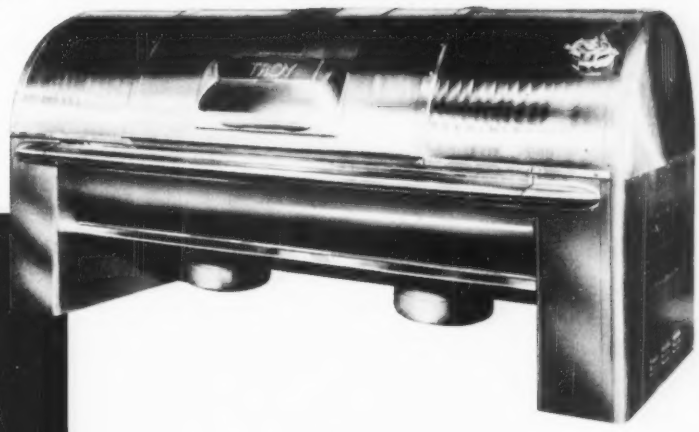

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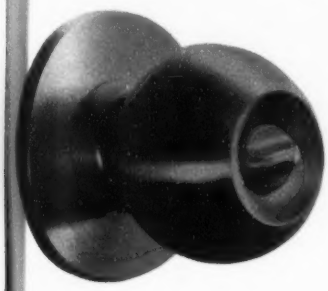

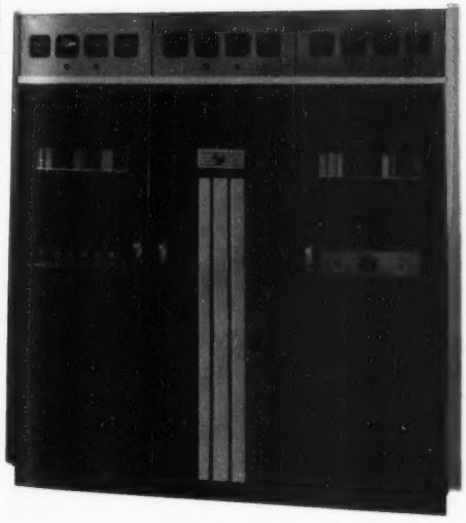

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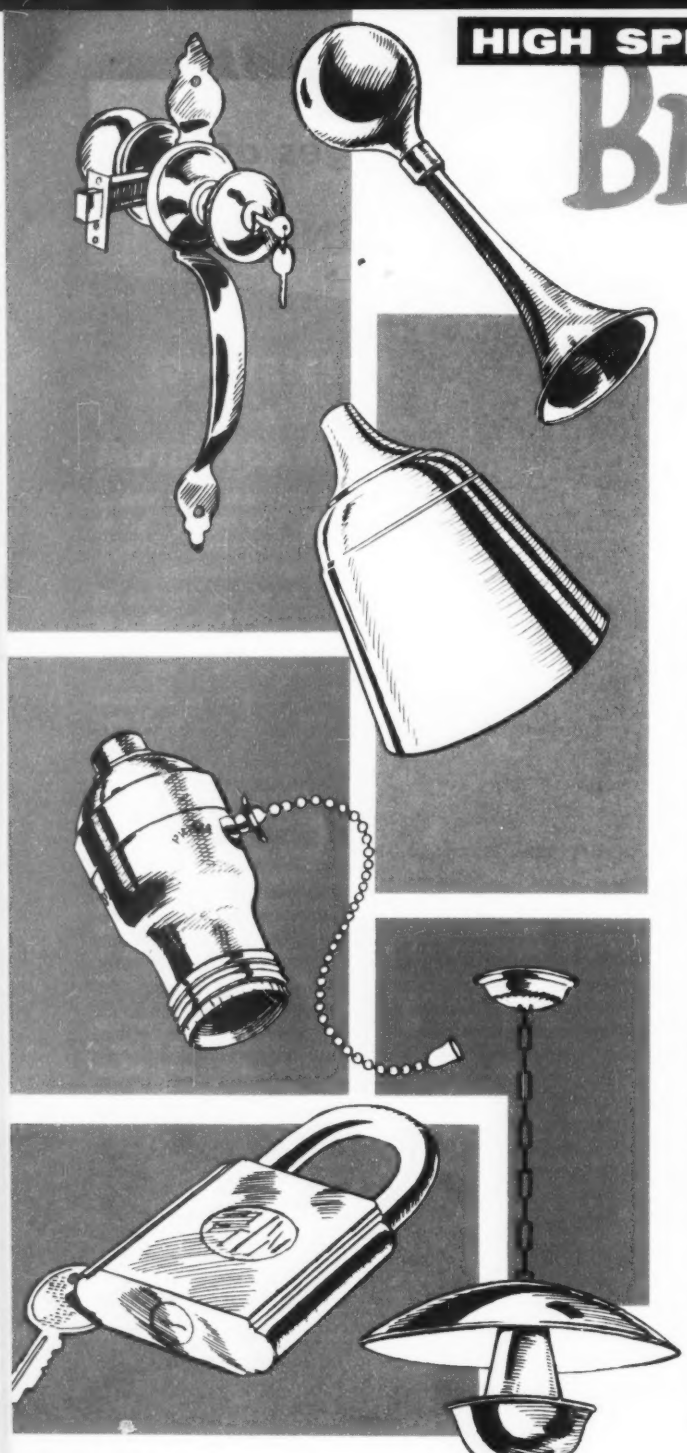

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ous acidic hexavalent chromium solutions, the improvement which consists in adding to the solution a saturated fluorocarbon sulfonic compound in sufficient amount to substantially decrease formation of spray and mist, said compound having 4-18 carbon atoms to each sulfonic group.

Chromium Bath

U. S. Patent 2,750,335. *June* 12, 1956. *H. Brown and D. R. Millage, assignors to The Udylite Research Corp.*

A bath for the electrodeposition of chromium comprising an aqueous acidic hexavalent chromium solution containing a compound having the formula:

$$CF_3(CF_2)_nCH_2N(R_1)(R_2)(X)(R_3)$$

where $n=2$ to 6, R_1 R_2 and R_3 are selected from the group consisting of hydrogen and hydrocarbons, the sum of the carbon atoms of $R_1+R_2+R_3$ being not more than 6, and X is an anion, said compound being present in sufficient amount to substantially decrease formation of spray and mist.

Chromium Bath

U. S. Patent 2,750,337. *June* 12, 1956. *H. Brown and D. R. Millage, assignors to The Udylite Research Corp.*

In a process of electrodepositing chromium from aqueous acidic hexavalent chromium solutions, the improvement which consists in adding to the solution the combination of 5-60 grams/liter of a material selected from the group consisting of pyridine and picolines and mixtures thereof, and a small amount of a compound effective to substantially reduce the formation of spray during chromium electrodeposition having the formula R_FSO_3X where R_F represents a saturated fluorocarbon chain of 4 to 8 carbon atoms and X is a cation.

Hot Dip Galvanizing Apparatus

U. S. Patent 2,750,923. *June* 19, 1956. *M. P. Daniel, assignor to General Electric Co.*

In a conveyor system for conveying articles into, through, and out of a liquid treatment bath, the combination comprising a main conveyor rail disposed above said bath, said rail having

a substantially horizontal trackway portion from a side edge of which a coextensive web portion rises substantially vertically, a wheeled carriage riding on said trackway, said carriage having a yoke disposed beneath said trackway for the support of an article to be treated, means for propelling said carriage along said trackway, and a lifter section arranged to be fixed to said rail to raise said carriage temporarily above the level of said rail, said section including a ramp engaging said trackway portion for interception of said carriage wheels to divert said carriage from said trackway portion and rising to a dwell portion disposed above said trackway portion in overlying relation therewith, an upstanding guard plate extending upwardly from a side edge of said dwell portion in the plane of said web portion, said lifter section terminating abruptly above said trackway portion to permit said carriage to drop sharply toward said trackway portion after traversing said dwell portion, and means for removably attaching said lifter section rigidly to said conveyor rail.

Chromium Bath

U. S. Patent 2,750,336. *June* 12, 1956. *H. Brown, assignor to The Udylite Research Corp.*

A bath for the electrodeposition of chromium comprising an aqueous acidic hexavalent chromium solution containing a compound having the formula:

$$H(C_2CF_2)_X(CH_2)_YZM$$

where Z is a radical selected from the group consisting of $—SO_3—$ and $—OSO_3—$, M is a cation, X is 2 to 10 and Y is 1 to 3, said compound being present in sufficient amount to substantially decrease the formation of spray and mist.

Gas Plating

U. S. Patent 2,749,255. *June* 5, 1956. *H. R. Nack and H. J. Homer, assignors to The Commonwealth Engineering Co. of Ohio.*

A process of plating a glass fiber roving consisting of a plurality of untwisted strands comprising a multiplicity of filaments with metal comprising the steps of heating the roving to the decomposition temperature of a heat decomposable gaseous metal bearing compound, and contacting the roving with said gaseous compound while vibrating the roving at a rate sufficient to expose the individual strands to the gaseous compound whereby metal is deposited on said roving uniformly.

Corrosion Inhibitors

U. S. Patent 2,749,311. *June* 5, 1956. *A. R. Sabol, E. K. Fields and R. E. Karll, assignors to Standard Oil Co.*

A new composition of matter, the oil-soluble reaction product of a mercaptan, formic acid and 2, 5-dimercapto-1, 3, 4-thiadiazole, said reactants being reacted in the molar ratio of from about 1:1:1, respectively to about $3+x:1+x:x$, where x is an integer from 1 to about 10, inclusive, respectively, at a temperature of from about 30°F. to about 250°F. said mercaptan having the general formula RSH in which R is an aliphatic hydrocarbon radical having from about 6 to about 30 carbon atoms.

Abrasive Finishing Machine

U. S. Patent 2,749,669. *June* 12, 1956. *M. B. Sleeper, assignor to Mecha-Finish Corp.*

A surface finishing device comprising a rotatable container for abrasive fluid, a carrier rotatable above said container about an axis inclined relative to the axis of rotation of the container, a plurality of work holders inclined relative to the carrier axis and depending from said carrier into said container, and means for driving said carrier and container at different speeds.

Aluminum Cleaner

U. S. Patent 2,750,309. *June* 12, 1956. *A. N. D. Pullen and E. D. Swann, assignors to The British Aluminum Co., Ltd.*

A method of cleaning aluminum and aluminum alloy surfaces which comprises immersing said surfaces for a short period of time in an aqueous alkaline solution which is held at a temperature in the range of 30° to 50° C. and contains an alkali-metal hydroxide in an amount of between 1.8% and 3.5% by weight, dissolved aluminum in an amount approximately half the weight of the alkali-metal hydroxide to ensure that a permanent deposit will appear in the solution, and the trans form of dinitrotetrammine cobaltic chloride in an amount in the range from about 0.01% to about 0.03% by weight.

Antimony Bath

U. S. Patent 2,750,333. *June* 12, 1956. *C. F. Smart, assignor to General Motors Corp.*

An electroplating bath consisting essentially of an aqueous solution of ammonium citrate, antimony potassium tartrate, and a small but effective amount up to about 60 grams per liter of an alkali metal salt of ethylene diamine tetra acetic acid.

Production of Uniform Deposits

U. S. Patent 2,750,332. *June* 12, 1956. *R. A. Miller, assignor to Pittsburgh Plate Glass Co.*

In apparatus for the electro-deposition of a metallic layer of constant thickness upon an electrically conductive surface having a conveyor adapted for supporting and conveying the said surface along a predetermined path and past an electro-depositing station for presenting successive areas of the conductive surface at said station, a supply tank containing an electrolytic bath, a positive electrode disposed in the supply tank and immersed in the bath, an applicator connected to said supply tank, a negative electrode connected to the electrically conductive surface and with the electrolyte on said surface, and means to connect a source of electricity to the positive and negative electrodes, said applicator comprising a nozzle for projecting said electrolyte onto the conductive surface at said station, and including depending means attached to the edges of said nozzle, said applicator being mounted at said station and relative to said conveyor so that said depending means substantially confines the electrolyte to said station without contacting said conductive surface.

Method of Plating Bearings

U. S. Patent 2,751,340. *June* 19, 1956. *R. A. Schaefer, H. V. Pochapsky and H. J. Sedusky, assignors to Clevite Corp.*

In a method of electroplating a uniform layer of metal of approximately .005 inch or less thick upon the bearing surfaces of flanged semi-cylindrical bearings, the steps which consist of placing the longitudinal edges of the bearings against and with the concave

surfaces facing, an insulating barrier element having a slot opening parallel to and centrally located with respect to the longitudinal edges of the bearings, the width of said slot being 22 to 28% of the diameter of the bearings and being further provided with inwardly projecting lips at each side of said slot with the inward projection of such lips being approximately 3 to 4% of the diameter of the bearings and the width of such lips being approximately 6 to 10% of the diameter of said bearings, and providing insulating shields projecting at right angles from said slots toward the bearing and being so spaced that the opening adjacent to the inner diameter of the bearing provides substantially no current leakage, the shields being 75 to 100% of the width of the flange faces of said bearings and the spacing of the shields between the bearings being 200 to 250% the width of the flange faces of said bearings, barrier element and shields in an electroplating bath, mounting an anode in the bath external to the barrier and passing a plating current from said anode to said bearing as a cathode.

Electrolytic Polishing Aluminum

U. S. Patent 2,751,342. *June* 19, 1956. *K. Guggenberger, assignor to Fromson Orban Co., Inc.*

A process for shining articles made of aluminum or aluminum base alloys, which comprises polishing the articles by anodically treating them in an electrolytic bath the acid components of which consist per liter bath of from 600 to 1,750 grams of sulphuric acid and from 3 grams of chromic acid up to the saturation limit.

Electropolisher

U. S. Patent 2,751,344. *June* 19, 1956. *C. A. Kienberger, R. E. Greene, I. C. Flanders and A. R. Flynn, assignors to the United States of America.*

An electropolisher for polishing one side of a substantially flat metal disc comprising a frame, a cathode support slidably mounted in said frame, an electrolyte container placed in juxtaposition to said support, an anode mounted in said container, a cathode having a substantially flat surface mounted on said support so that its surface is essentially parallel to the surface of said anode and in alignment therewith, means for holding a metal disc at a fixed distance from said cathode, said support, anode, cathode, and disc-holding members having a common vertical axis, and means for bringing said cathode within said container and for contacting the upper surface of said anode in pressure relation with the lower surface of said disc.

Electroplating Rack

U. S. Patent 2,751,345. *June* 19, 1956. *M. G. Osman, assignor to Radio Corp. of America.*

In a plating rack comprising a base portion and a masking portion adapted to be positioned adjacent a surface of said base portion, a plurality of locking cams spaced about the periphery of said base portion, each of said locking cams providing an external surface spaced from said base portion, an inclined shoulder joining said external surface and said base portion, said external surfaces of said plurality of locking cams defining supporting plane parallel to said base portion, each of said locking cams having an internal cam surface inclined with respect to said surface of said base portion, a plurality of radial extensions spaced about the periphery of said masking portion, a plurality of other radial extensions spaced about the periphery of said masking portion, each of said internal cam surfaces being engaged with one of said first named radial extensions, each of said other of said radial extensions being engaged with one of said external surfaces, means for locking said masking portion when said other of said radial extensions are engaged with said external surfaces, means for rotating said masking portion with respect to said base portion, and said masking portion being locked against said surface of said base portion by said internal cam surfaces.

Thickness Gage for Metallic Coatings

U. S. Patent 2,751,552. *June* 19, 1956. *A. Brenner and B. J. Wagoner, assignors to the United States of America.*

A gage for measuring nondestructively the local thickness of a nonmagnetic metallic coating on a nonmagnetic metallic base, said gage comprising: a first circuit having a unilateral conducting device in series with a parallel combination of a point contact type probe having wound thereon a self-inductance test coil with a diameter of less than one-eighth inch and a variable capacitor, said coil and capacitor combination being resonant at a frequency in excess of 100 cycles; a second circuit having a unilateral conducting device in series with an impedance, said second circuit being connected in parallel with said first circuit; a first means for supplying to said first and second circuits an alternating current of a frequency that is greater than 100 cycles and that is approximately equal to the resonant frequency of said coil and capacitor combination in said first circuit; and a second means for comparing the current through said first and said second circuits.

Bar and Tube Pickling Machine

U. S. Patent 2,751,916. *June* 26, 1956. *R. Hampton, assignor to Patents and Investments, Ltd.*

Apparatus for pickling bars, comprising, in combination with a bath for the pickling liquid, cradle means for supporting the bars in said bath and power driven mechanism which operates upon said cradle means in a repeating cycle, so as to impart movement to the supported bars, by slowly raising said cradle means and then allowing same to lower rapidly.

Buff-Making Machines

U. S. Patent 2,752,202. *June* 26, 1956. *M. Schloss.*

In a device of the character described, in combination, a circular support, an inner plurality of circumferentially spaced fingers pivoted to said support to swing inward thereon in radial planes from positions substantially in a cylindrical surface parallel to the axis of said support to positions substantially in a common plane normal to said axis, an outer plurality of circumferentially spaced fingers pivoted to said support to swing inward thereon in radial planes intermediate said first mentioned radial planes from positions outwardly beyond said cylindrical surface to positions substantially in said common normal plane, and means to swing all said fingers from said outer positions simultaneously into said inner position.

Blast Gun

U. S. Patent 2,751,716. *June* 26, 1956. *C. B. Pletcher.*

A sand blast gun comprising a body

member having an axial passage, a portion of said passage being internally threaded, said passage having an inner end terminating in a coaxially enlarged valve chamber, a rod axially disposed in the passage and having a portion of its surface externally threaded and enmeshed with the threaded portion of the passage, the threads on both parts being acutely pitched so that a slight rotational movement of the rod will effect a considerable axial movement thereof in the passage, said rod extending outwardly of the passage and having an enlargement, provided with an undulated peripheral surface, on its extending end for manually rotating the rod to move it axially of the passage, an enlarged cylindrical valve body detachably socketed on the inner end of the rod and disposed in the valve chamber, said valve body having an inwardly tapering end and being of less diameter than the valve chamber, a mixing chamber attached to the body member and aligned with the valve chamber and disposed forwardly thereof, a partition disposed transversely between the valve chamber and the mixing chamber, said partition having a wall facing the valve chamber and a valve seat formed in such wall and being outwardly flared to receive the end of the valve body, said body member having an inlet bore of constant cross-section for water under pressure formed below the passage; said inlet bore being curved forwardly and tangentially opening into the bottom of the valve chamber and extending over the entire bottom of the valve chamber, a jet nozzle removably fixed in the partition bore and extending forwardly into the mixing chamber, said nozzle having an axial bore of considerably less diameter than the bore in the partition and of constant cross-sectional area and communicating centrally with the valve chamber and the mixing chamber, an inlet nozzle for air and sand communicated with the mixing chamber, said mixing chamber having a threaded opening in its top wall and the inlet nozzle having a lower end threaded in such opening so that the inlet nozzle is disposed perpendicular to the mixing chamber and at right angles to the jet nozzle, said jet nozzle terminating in alignment with the inner wall of the inlet nozzle and a discharge nozzle carried by the mixing chamber and extending forwardly thereof, said discharge nozzle having an axial bore aligned with and axially spaced from the jet nozzle and said bore of the discharge nozzle tapering forwardly from the mixing chamber and terminating outwardly in an outlet section of constant cross-sectional area.

Aluminum Staining Inhibitor

U. S. Patent 2,755,167. *July* 17, 1956. *W. Y. Bleakley, assignor to Kaiser Aluminum & Chemical Corp.*

A method of inhibiting water stain on aluminum sheet material which comprises placing between adjacent surfaces of the metal sheet material a fibrous sheet material containing impregnated therein a soluble chromate in amounts not substantially less than 0.75% and not substantially in excess of 4% by weight of impregnated material.

ABSTRACTS

Mechanism of Chromium Deposition

A. I. Lewin: *Shurnal Fisitscheskoi Chimii* (Journal Physical Chemistry—Russia). Vol. 28, No. 9, p. 1652.

The polarization curves of aqueous chromic acid solutions with the addition of various foreign salts were taken on cathodes of various metals—plati-

num, copper, silver, iron, zinc, cadmium, nickel, chromium. All the phenomena observed could be explained if it was assumed that, at the cathode, there resulted a direct reduction of chromate ions to Cr^{+++} ions or elemental chromium.

Stability of Polished Aluminum Surfaces to Tarnishing

H. W. Ginsberg and F. Baumann: *Metall.* Vol. 9, p. 160 (1955).

The authors investigated the chemical stability of freshly chemical polished aluminum surfaces in relation to the composition of the metal. A theoretical consideration was also developed regarding the procedure with chemical polishing of aluminum. The tests were conducted with pure aluminum, 99.9, and 99.9 + 0.6 Mg., in three rolling grades as well as with 99.8 + 0.5 Mg., and 99.6% aluminum. The metal was chemically polished by the Erftwerk and VLW processes and anodically by the Brytal process. The polished surfaces were then pickled in sodium chloride—acetic acid and the loss of weight determined. It was found that polished fresh surfaces were more strongly attacked than the bright rolled or mechanically polished surface. Roughened surfaces, i.e. by brushing or sand-blasting, show greater chemical attack. Consequently, the conclusion can be drawn that roughened, unprotected polished surfaces fundamentally need to be anodized.

The chemical stability of the polished surfaces is strongly dependent on the polishing processes used. From the investigation, the authors came to the conclusion that passivating sealing coatings are formed in the chemical polishing process, which govern the polishing mechanism. Apparently, three processes occur simultaneously at the metal surface during polishing, namely:

1. Attack of the metal with the formation of easily soluble aluminum salts;

2. Attack on the metal with the formation of more or less firmly adherent passivating coatings or sealing coatings;

3. A continuous solution of the sealing coatings.

These sealing coatings formed are not so coherent as the coatings formed with anodic polishing processes and so allow of greater chemical attack on the polished surface. It is considered that the chemical polishing action occurs not as a result of levelling of surface irregularities but more by a prevention of surface etching.

Silicon Coatings on Steel for Surface Protection (Siliciding)

E. Fitzer: *Archiv. fuer das Eisenhuettenwesen.* Vol. 25, No. 11/12, p. 601.

The siliciding process for coating steel is a gaseous process in which the silicon is coated on the steel by precipitation from gaseous silicon halogen compounds. This is the process mainly used, although the solid cementation process can be employed, with which the parts to be silicon coated are packed in silicon, ferro-silicon or silicon carbide powder and heated in a halogen-containing atmosphere. The vapor phase process employs mainly gaseous silicon tetrachloride for the process. With both processes, an acid resistant Fe_3Si coating is obtained by diffusion of the silicon into the steel, the coating containing 12-14% silicon.

The Fe_3Si coating formed will withstand temperatures up to 500-600°C. for long periods but, at higher temperatures, the coating will tend to part from the steel. Tests showed that the chloride siliciding is an easily controllable process, unlike the solid cementation procedure. The hologen gas sili-

ciding leads to the formation of Fe_3Si coatings with 12-14% silicon.

Coloring Various Metals with a Universal Coloring Bath

Metalloberflaeche. Vol. 9, No. 10, p. 153 B.

In metal coloring practice, there has been a desire for a considerable time for the development of a coloring bath which will remain stable over a long period and with which not only one particular metal but several metals can be treated, and this also in various color shades. This, for example, is not the case with the old classical liver of sulfur coloring bath. The potassium permangante coloring bath, however, permits not only the coloring of copper, brass and bronze, as well as other copper alloys but also zinc, cadmium, and zinc and cadmium coated metals; further also aluminum and magnesium alloys and, although not quite as well, tin and lead metals can also be colored up in this bath. The colors produced can be shaded off in various tones from light to dark brown, green to red brown, or black brown and deep black.

Perhaps the most important commercial use of this bath is the coloring of copper and the copper alloys. For instance, considerable commercial use is made of the process for the black coloration of metal parts for the optical industry. A solution used is 100-150 g./l. copper sulfate, and 15 g./l. potassium permanganate. Developments have led to the universal bath for the brown coloration of copper, brass and bronze, and other copper alloys; a suitable composition for this bath is 50 g./l. copper sulfate and 5 g./l. potassium permanganate. With this concentration there are obtained satisfactory, good adherent colors; if the potassium permanganate concentration exceeds 7.5 g./l., the adhesion is not so good on bending. The baths are generally used at the boiling point, but continuous boiling should be avoided as the stability of the bath will suffer. The parts are generally immersed in the bath; with large parts, however, the coloring solution can be brushed on. A stoneware tank is best for the bath. A brown color can be obtained with copper sulfate solution alone, but weaker than when permanganate is used. Tests were made to replace the copper sulfate with other sulfates or other copper salts. By partial replacement with copper nitrate it was found that, on brass, on which the color is usually a greenish-brown, darker and more red-brown colors are produced; the color is also greener upon replacement with zinc sulfate; nickel sulfate gives more greenish-brown colors. Tombac and semi-tombac alloys color up best deep brown; brass generally attains a greenish shade; bronze is less darkly colored; copper plate from cyanide baths colors up better than that from acid baths.

Metal Surface Cleaning and Pretreatment

H. Rogner: *Technische Mitteilungen.* January 1955.

The author first surveys the methods in use for the surface pretreatment of metals by the application of chemical and mechanical cleaning processes. With organic solvent degreasing, a fat-free surface can only be obtained with perfectly clean solutions in the vapor phase, or with several liquid solvent stages. The water-soluble alkaline degreasing process is discussed in detail. The boundary surface phenomena are of outstanding importance. A good wetting agent must possess wetting, emulsifying, and dirt-carrying characteristics. Caustic soda or calcined soda are not sufficient from the practical standpoint. Phosphates and silicates possess emulsifying and emulsion-stabilizing characteristics. Foam-building cleansing mediums can certainly be used with boiling or flow processes but not with spray processes.

The choice of the cleansing medium to be employed will be governed by the metal. Iron and steel can be treated in an alkaline medium. Cleaning media for aluminum and its alloys contain silicate additions. On account of the water-sensitivity of magnesium and its alloys, the ware must be dried as quickly as possible. The steam spray process deserves mention, in which the cleaning solution is atomized with steam and sprayed on the metal. The subsequent rinsing is of great importance to the cleaning.

Emulsion cleaners are generally emulsions of hydrocarbons, for example petroleum spirits, in water. These emulsions with a solvent medium content of 0.5-2% are mostly sprayed at 50°-70°C. Their advantage is the neutral or only weakly alkaline reaction. With the addition of a corresponding acid, there can be conducted simultaneously both degreasing and pickling. With subsequent phosphating, there is obtained with the non-visible residues of the emulsion cleaner, uniform and very finely crystalline phosphate coatings. What are termed cold cleaners are water-soluble organic solvent cleaners. In practice, they form the transition from the purely organic solvent media. A subsequent water treatment is necessary with their use.

Pickling Techniques

J. Heinrich: *Technische Mitteilungen,* Jan. 1955.

When pickling before a surface treatment, more care must be taken than in pickling while the metal is being formed, as for example with rolling processes. In this former case cleanliness, surface appearance, surface projections and valleys, pores, etc., are of outstanding importance. For a subsequent surface treatment, pickling residues are particularly undesirable. Passivation of the metal surface has a great significance; this signifies an upgrading of the surface. The individual pickling processes are discussed and it develops that the regeneration proceedure has been solved for sulfuric acid pickle baths, but not for hydrochloric acid baths. Phosphoric acid pickles can be regenerated with ion exchangers; this is of great importance because of the cost reduction obtained.

Phosphating and Chromating of Aluminum and Its Alloys

V. H. Keller: *Aluminum* (Germany). Vol. 31, p. 5 (1955).

The author discusses the anodizing treatment: uniform formation of the surface coating, coating thicknesses up to 30 microns, high hardness and good coloring properties. A disadvantage is the relatively high production cost.

As a pretreatment for lacquering, the non-electrolytic acid and alkaline processes can be used with good results and are considerably cheaper. Their advantages are the formation of an adhesive surface coating of 0.1 to 5 microns thickness, providing a good adhesion base for subsequent lacquering, high corrosion resistance of the combined surface coatings, low costs of the coating.

In the alkaline baths — MBV, EW and Pylumin—the processes are generally operated with the aid of chromates, aluminum oxide coatings being produced whose thickness and hardness is less than that of the anodized coatings. These processes, however, often substitute for anodizing. A disadvantage is the non-uniform appearance of the coating and, particularly with the copper-containing alloys, a softness of the coating. These disadvantages are removed by the acid processes of chromating and phosphating. The chromate baths, in addition to chromic acid and chromates, contain acids and fluorides or complex fluorides. They work at a maximum of 50°C. and without trouble. These processes roughen the surface and simultaneously form a low-pore 0.1 to 1 micron thick coating which is golden-yellow or, with phosphoric acid addition, gray-green, which can be shaped, welded, and is a good adhesion ground for lacquers. The corrosion resistance is good. One process forms the transition to the phosphating process; a mixture of phosphoric acid, chromic acid and hydrofluoric acid is used and a 2-3 micron thick, gray-green coating is formed. Mixed surfaces of iron, zinc, and aluminum can be treated by some processes. Zinc phosphate coatings are mat, light gray, and 1-5 microns thick. Their wear resistance and bend strength are good, absorption for oils, etc., is very good. Lacquer adhesion and corrosion resistance are very good.

Coloring Non-Ferrous Metals

H. Anders: *Metallwarenindustrie und Galvanotechnik.* Vol. 45, No. 9, p. 437.

Before coloring, the metal surface must be thoroughly cleaned and, in some cases, polished. If a mat appearance is desired, then the metal is given a sand-blasting before coloring. A mat dip can also be given; thus, nickel-copper alloys can be dipped in 20% sulfuric acid or in a dilute cold solution of 1 part sulfuric acid, 1 part nitric acid and 5 parts water. For the mat pickling of Monel metal there can be used a 10% sulfuric acid solution or a 50% hydrochloric acid solution, each containing 2% sodium chromate or iron nitrate at 60°-80°C. Zinc is pickled in 2-20% cold H_2SO_4 or HNO_3. The ware is dipped for 1-2 seconds and thoroughly rinsed. It is important to take extreme care over this stage of the metal pretreatment, because surface defects will not be covered up by the coloration, but will show up more prominently.

Alloys will often require different coloring treatment from pure metals. Thus, the well-known ammoniacal black bath for brass, for example, will give only a weak brown on copper and will give only a deep black on brass with a medium zinc content. Tin-rich bronzes are difficult to color, while high-nickel-containing alloys cannot be colored in the baths used for coloring copper alloys. Baths containing 124 g./l. sodium thiosulfate and 38 g./l. lead acetate, will give a good blue coloration on copper alloys. With a bath containing 240 g. sodium thiosulfate, 25 g. lead acetate and 30 g. potassium tartrate in 1 liter water, a whole range of colors can be obtained on brass, ranging from golden-yellow to violet, blue and red-green. The more copper-rich the alloy, the quicker the color develops. Patina green coloration on copper and its alloys is obtained with a bath containing 10 g. ammonium chloride, 30 g. potassium tartrate, 40 g. sodium chloride and 50 g. copper nitrate in 250 cc. water.

Zinc, or zinc alloys such as die castings, can be colored in a bath containing equal parts of a 10% copper sulfate solution and a 1/120% picric acid solution. Zinc can also be colored in a molybdate solution, a brownish color tone being obtained.

Troubles in Nickel Baths and Their Removal

A. Stocker, A. Korbelack and S. A. Carrano: *Metalloberflaeche.* Vol. 9, No. 12, A207.

Dealing first with a dark deposit, this can be caused by impurities in the bath, due to the presence of too much copper, zinc, lead, or cadmium. These impurities are then removed by selective purification. Another cause is a improper concentration. This can be caused by too great a dilution or too-high current densities, of a mat nickel bath, giving dark deposits. The remedy is analysis of the bath and, if required, suitable additions. Another cause can be high pH. A dark deposit is obtained, due to the separation of basic nickel salts. The remedy is a suitable adjustment of the pH value to remove the trouble.

A somewhat allied trouble in nickel baths is a dark deposit at angles and edges. This may be due to metal in the bath. The bath should again be tested for impurities such as copper, zinc, cadmium, and lead. Removal should be carried out by selective purification. Another cause is organic impurities in the bath. An indication of the presence of these can be made by means of a test with the Hull cell. The trouble can then be dealt with by removal by means of activated carbon. Another factor which can lead to trouble of this nature is the employment of a low current density. The remedy is to employ a current density which is set as high as is possible, but without running into another trouble, which is burning at the edges if the current density is too high.

Copper Plating Aluminum

A. Miyata and K. Isawa: *Repts. Science Research Inst.* (Japan). Vol. 29, p. 280.

A pure aluminum sheet was first coated with an oxide film of 1-20 microns in thickness by electrolysis, according to the following:

A. Electrolyte: 3% Oxalic acid
Bath temperature: 18-19°C.
Current density: 2.76 amp./sq. dm.
Voltage: 105-110 volts a.c.
Treatment time: 3-60 minutes.

The sheet was then anodically treated with:

B. Electrolyte: Sodium carbonate solution.
Temperature: 18-19°C.

Copper plating was then applied as follows:

Electrolyte: Copper sulfate 250 g./l.
Sulfuric acid 75 g.
Bath temperature: 30°C.
Current density: 5 amp./sq. dm.
Anodes: Copper.
Voltage: 0.7 to 0.9 volts up to 17 microns thick (75 microns in 1 hour).

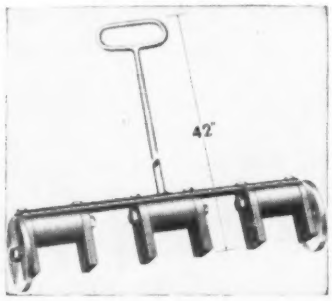
The Jaquet method was used to test the adhesion; it was established that the adhesion of the copper plate to the aluminum was excellent.

Recent Developments

NEW METHODS, MATERIALS AND EQUIPMENT
FOR THE METAL FINISHING INDUSTRIES

Tank Magnet

Belke Mfg. Co., Dept. MF, 946 N. Cicero Ave., Chicago 51, Ill.



Quick and easy recovery of pieces lost in plating tanks and clinging in corners of plating barrels, also separation of iron from nonferrous metal chips is afforded by a multiple unit tank magnet.

The gang of powerful permanent magnets covers large tank areas quickly and picks up parts from the bottom without stirring up sediment. Merely moving the magnets through metal cuttings picks out iron and steel from brass, copper, zinc, aluminum and other nonferrous chips.

Available with one to three magnets with or without support wheels, the standard overall length including handle is 42".

51/Circle on Readers' Service Card

Spray Washing Compounds

Magnus Chemical Co., Inc., Dept. MF, Garwood, N. J.

This new line of spray washing compounds contains a non-foaming wetting agent that allows for maximum wetting of dirt deposits without the troublesome build-up of foam. With these new products, there is no restriction as to the concentration used to obtain the cleaning result desired. Regardless of concentration and high temperature, the solution will not foam.

Magnus "X-3" compounds have unmatched cleaning ability because they are fortified with higher concentrations of wetting agent. Their built-in hard water control prevents scale formation, the free-rinsing properties leave surfaces water-break free and their cleaning action guarantees much cleaner work. Obtainable in three strengths for hard, medium and soft metals, these spray washing compounds, when used according to directions, do not attack metal surfaces and present no hazard to equipment or personnel, it is claimed.

Compound 91X3 is recommended for cleaning aluminum, 92X3 for more chemically resistant alloys of aluminum plus brass, bronze, copper, steel and mixed alloys of these metals, and 94X3 for heavy duty cleaning of steel.

52/Circle on Readers' Service Card

Coatings for Zinc and Cadmium Plate

Metal & Thermit Corp., Dept. MF, Rahway, N. J.

Four new low-cost Unichrome dip compounds to be used as finish coatings in zinc and cadmium plating operations have been field tested and found suitable for hand operated still tanks, barrels, and fully automatic machines, according to the above manufacturer.

On zinc plated parts, Dry Dip Compound 1085 gives a bright, clear coating to the zinc plate and is considered ideal for products plated in bulk and subject to outdoor exposure. Used in low concentration, it improves appearance and shelf life of plating at low cost. Where a brightener is also used in the zinc plating, it reduces amount of brightener required. A single 5 to 20 second dip greatly facilitates rinsing of plated work. The product is a leachless, chromate type dip with exceptionally long tank life.

Having the same properties as the dry 1085 dip compound, but furnished as a liquid concentrate, Dip Compound 1090 is used in solutions of 50 volumes to one, and provides very low cost finishing. Especially adapted to finishing cadmium plated parts but also employed with zinc plating, this material provides an economical, corrosion-resistant finish. Used in low concentration it is particularly suitable for finishing thin plated bulk work in either hand operated or automatic lines. Tests show that the compound provides excellent luster, leachability and stability and that the finish will stand up against a standard salt spray test for approximately 40 hours.

Unichrome Dip Compound 99 is a liquid version of 1084.

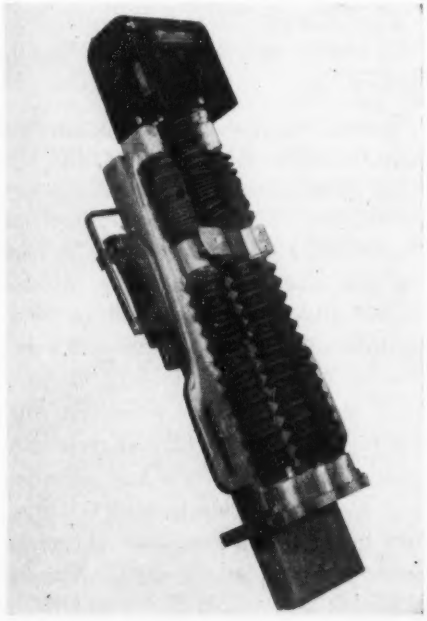
53/Circle on Readers' Service Card

Buffing Compound Applicator

George L. Nankervis Co., Dept. MF, 15300 Fullerton Ave., Detroit 27, Mich.

A brand new air-operated buffing compound applicator permits the application of a full ten inches of compound without resetting or adjustment. Designated as the Model 1006, the new applicator has many other new features to improve buffing operations. It can be installed on all types of buffing machines from simple lathes to multi-operation automatics. Lightweight construction, less than 24 pounds, permits installation on floating heads without disturbing balance. It can be installed in any position without effecting operation.

An important feature of the new applicator is its ability to feed any



number of strokes per minute, applying compound only when required. For example, it can be installed so as to apply compound only during the buffing cycle, withdrawing while the work changes from station to station in the machine. In addition, it is also possible to operate up to eight applicators simultaneously from a single controlling valve, applying compound uniformly to all buffs. With each application, the compound is fed forward to compensate for "wear-down" of the bar. The rate of feed is adjustable from .0015" to .015" per stroke.

Major parts of the applicator are fabricated of cast aluminum to minimize overall weight. All operating parts are covered to seal out dirt, wheel lint and compound. Moving parts are bearing-mounted to insure trouble-free service and smooth operation.

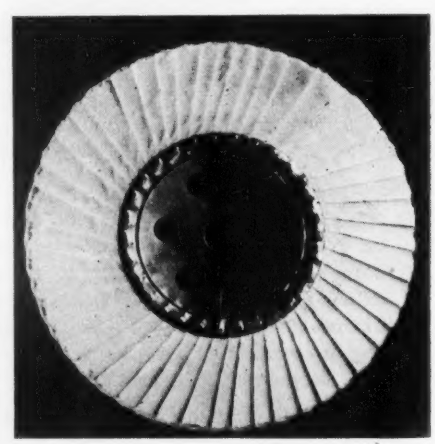
56/Circle on Readers' Service Card

Pleated Buff

Diamondaire Buff Co., Inc., Dept. MF, 1308 Cromwell Ave., Bronx 52, N. Y.

According to the above company the construction of their all-pleated fabric buffs offer many distinct advantages. Some of them are:

1. Maximum ventilation and true "air conditioning," both of which reduce burning to a minimum or eliminate it entirely.
2. Extremely effective cut combined with high coloring results.
3. Considerably greater useful "life" for the buff.



These buffs are competitively priced and presently available in 14, 16 and 18 inch sizes in all fabrics and a variety of section widths. Buffs are constructed on bias cut with velvetized finish.

57/Circle on Readers' Service Card

Hydraulic Automatic Polishing Machine

Curtis Machine Div., The Carborundum Co., Dept. MF, Jamestown, N. Y.

It is now possible for any stainless steel fabricator whose production does not warrant the purchase of a wide belt sheet polisher to use the Model 43-R3 Hydraulic Automatic Stroke Polisher to polish either 2B roll mill sheets or formed flat surfaces to an equivalent No. 4 finish or better.

The new unit employs an hydraulic system which powers a traveling head at 80 to 90 eight foot strokes per minute, with longer strokes possible. A buff roll mounted on the traveling head backs up the 6" wide abrasive belt with a "soft" pressure that gives a uniform finish. The stock table reciprocates under the belt with grind pressure, either by manual or air pressure control. The scratch pattern created is longer than mill-furnished standard No. 3 or No. 4 finishes, but more approximates the final finish which a fabricator ships on his product. The finish is much easier to simulate by hand as it is very close to the final finish. With the weld removal and blending operations required, the true No. 4 finish would be lost as it cannot be duplicated by any hand method now used.

The machine can be built to accomodate any length or width capacity. It can also be used for weld removal, surface cleaning prior to painting, scale removal, filler sanding and many additional operations.

58/Circle on Readers' Service Card

Low Cost Zinc and Cadmium Brighteners

Allied Research Products, Inc., Dept. MF, 4004-06 E. Monument St., Baltimore 5, Md.

The above manufacturer has announced the addition to its line of two new lower cost brighteners, ARP No. 52, a zinc barrel brightener addition

agent that provides a uniform lustrous deposit, and ARP No. 41, a brightener addition agent for cadmium that produces improved luster.

The zinc brightener is a powder, available in 10, 50 and 100 lb. fiber drums. It provides excellent luster directly from the zinc barrels and, while the finish may tend toward a slight yellow cast, ½% nitric acid or an Iridite dip produces a beautiful clear-bright. The particular advantages of the brightener lie in its low cost per pound and its low rate of consumption and stability, resulting in the lowest over-all operating costs possible. Field testing over a two year period, as compared with just about every other zinc brightener on the market, has proved that it cuts cost up to one-half in many cases, according to claims.

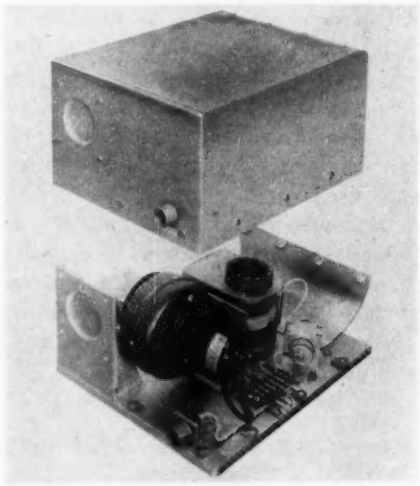
The cadmium brightener is a liquid, available in 5-gallon pails. It is claimed to provide improved luster over known competitive products, operates over a wider range of current densities, is compatible in plating solutions formerly using addition agents containing nickel salts, and rinses unusually free of water breaks.

60/Circle on Readers' Service Card

Electrosonic Cleaning Unit

John B. Moore Corp., Dept. MF, 349 Franklin Ave., Nutley, N. J.

The new Telephonics Tank Mounted Transducer, newest unit in the field of ultrasonic cleaning, is stated to



New Electrosonic Transducer, Showing Air Cooling Elements.

provide industry with a larger capacity transducer for efficient conveyor operations, and to permit ultrasonic cleaning of larger objects or greater number of small objects. The new transducer

is of the magnetostrictive type which is effective over the entire cleaning area, and is recommended for dual mounting on production line tanks, or on separate tanks where portability is desired.

The unit is claimed to be the only air-cooled ultrasonic generator. The absence of water-cooling helps to maintain the desirable low humidity essential in precision work.

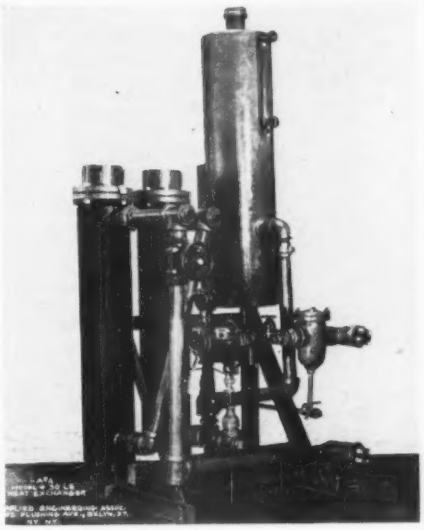
61/Circle on Readers' Service Card

Heat Exchange System

Applied Engineering Associates, Dept. MF, 1952 Flushing Ave., Brooklyn 37, N. Y.

A new series of self-contained leakproof heat exchange systems are designed for operating temperatures up to 450°F. Special units are available for operation at temperatures up to 1,000°F.

The unit illustrated, Model No. 3LE, is typical of the system's construction. This unit features a sealed centrifugal pump rated for 90 ft. head at 53 gal./min. (pumps are available for 194 ft. head at 300 gal./min.) The heat transfer fluid circulates through the motor providing lubrication for the bearings. A 30KW 3 phase heater arrangement with integral thermostats maintains an accuracy of ± 2°F. Long heaters with flat cross-sections permit efficient and uniform transfer of heat to the heat transfer fluid and eliminates danger of over-heating. The heating elements are readily removable for inspection and cleaning. The large expansion tank permits expansion of the heat transfer fluid during heat-up cycle and provides oil make-up during the air bleeding of the system. The height of the tank assures sufficient head pressure at the suction side of the pump to prevent cavitation during pumping. A sight glass permits visual check of the fluid level in expansion tank.



A relief valve protects piping and pump from excessive pressures. In-line filters protect the pump by preventing entry of solids into the pump. Saunders type packless diaphragm valves permit isolation of the pump so that it may be removed without draining the system. The piping can be easily broken down for cleaning and inspection. Indicating temperature controllers are provided for remote panel mounting.

Variations to suit special requirements can be incorporated into this basic system design.

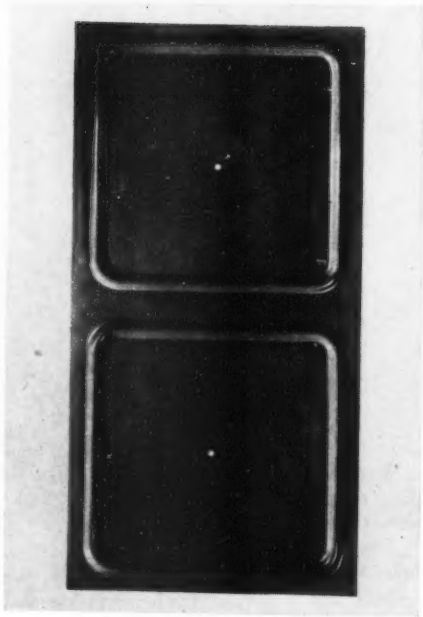
62/Circle on Readers' Service Card

Tank Lining

H. N. Hartwell, Industrial Plastics Div., Dept. MF, Park Square Bldg., Boston 16, Mass.

The Expansion Liner Sheet is claimed to be industry's first and only tank liner with built-in thermal compensation. Constructed of Boltaron 6200 unplasticized polyvinyl chloride (type I), the expansion sheet successfully combines the high corrosion-resistance of PVC with industry's increasing demand for larger size tanks and greater allowable temperature differentials. The expansion sheet was designed to absorb the expansion and contraction of this rigid tank liner by movement of corrugations built into the individual sheets. These corrugations fully compensate the entire sheet in all directions and are capable of absorbing much more.

The individual sheet (30″ x 60″ x $\frac{3}{16}$″) allows lining tanks of almost unlimited size since expansion and contraction is confined to the individual sheet. The problems of buckling, warping and other distortion usually



encountered in other types of lining are virtually eliminated. The sheet can be used with tanks of wood, concrete, new or even badly corroded metal, or practically any other material. It can be used in any size tank, square or rectangular.

64/Circle on Readers' Service Card

Passivator for Cadmium Plate

The Conversion Chemical Corp., Dept. MF, Rockville, Conn.

Kenvert No. 27, a one-dip powder, is designed to passivate and give a uniform appearance with brightness to cadmium plated work where brighteners are used in the bath. The result is a clear, white metallic color without the yellowish hues usually associated with chromic acid bright dips on cadmium, on baths with or without brighteners. It gives excellent corrosion protection, resistance to staining and fingerprinting, and adhesion to clear lacquer films. It is produced for operators of bright cadmium baths who are interested in passivation, sealing and uniform brightness. It is economical to use, and is packaged in disposable, polyethylene-lined steel drums. No special ventilation of any kind is required for its use, and it operates satisfactorily from 65° to 75°F. in either manual or automatic cycles.

This single-dip process is excellent for use in facilities which have limited tank space after plating.

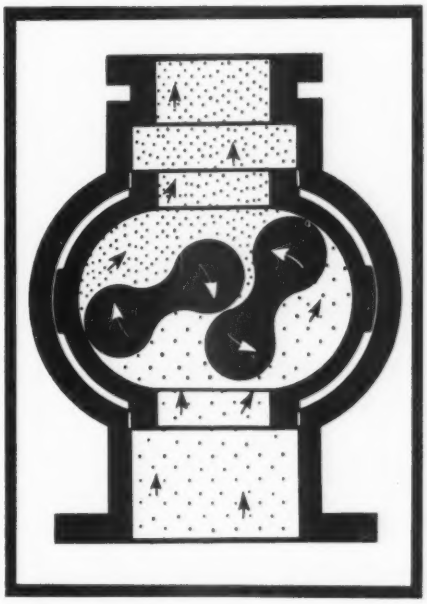
65/Circle on Readers' Service Card

High Vacuum Pumps

Rochester Div., Consolidated Electrodynamics Corp., Dept. MF, 1775 Mt. Read Blvd., Rochester, N. Y.

A new line of fast, Roots-type vacuum pumps is now available to industry. Available in six standard sizes, they cover maximum speed ranges from 92 to 4,900 cubic feet per minute.

Basic mechanism of these pumps is a pair of figure-eight-shaped rotors which counter-rotate in the pump chamber. These finely machined rotary pistons never touch one another or the pump casing. Consequently, no oil sealing in the pump chamber is required which would contaminate the vacuum system with backstreaming vapors.



Featuring quiet, vibration-free operation and low power consumption, these pumps have motors which operate within the vacuum, eliminating need for shaft seals, which are frequently sources of leakage. Roughing is done directly through the pump without the need of by-pass or valving. The pumps are reported to be the world's fastest mechanical pumps in the 10^{-1} to 10^{-5} mm. Hg range.

67/Circle on Readers' Service Card

Filter Material

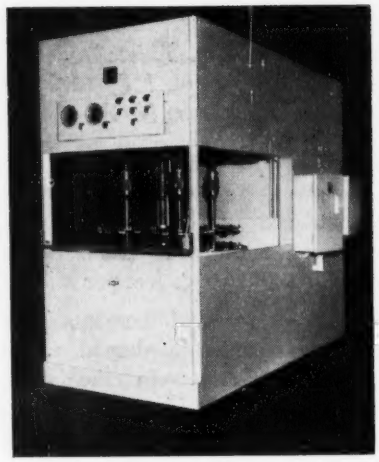
Cuno Engineering Corp., Dept. MF, Meriden, Conn.

A new 5-micron (0.0002") filter cartridge is made of white cellulose, bonded with a totally inert resin. The new "White Micro-Klean" cartridge is recommended for filtration problems where fluid polishing to extreme clarity is required with no contamination of fluid or impairment of taste.

The new cartridge, which fits most standard filter housings, is expected to replace the string-wound cotton filters previously used in these applications. Highly alkaline fluids, in particular, are handled without contamination of the fluid or deterioration of the filter cartridge.

The new filter features a "graded density" construction, which traps out larger particles early in the flow path, preventing "plugging" or "plastering up" of the finer filter barriers that follow.

68/Circle on Readers' Service Card



high degree of finish control can also be maintained when necessary.

Operating cycles of the process, it is reported, vary in time from four to 16 minutes. A newly designed fixture for the machine permits locking or unlocking of parts on the fixture with a single turn of a cam, further saving setup time and speeding production. The greatest economies of the process, according to the above manufacturer, result from its use on complex parts which formerly required equipment and labor for several buffing operations. Simple pieces, however, are run with equal saving.

71/Circle on Readers' Service Card

Backstand Idler

Fenlind Engineering Co., Dept. MF, 5602 Pike Road, Loves Park, Ill.

An unusually long lifetime is assured this versatile idler through the use of boots and seals which protect all working parts from dust, dirt, abrasive particles, etc. Known as the L-610, it incorporates a number of exclusive features which make it adaptable to any application, from precision work with narrow belts to the heaviest roughing operations.

Linkages consisting of telescoping remote control arms and universal joints permit the mounting of both tracking and tension arms at any position, above or on the front of the polishing lathe, to suit the operator's convenience. The telescoping feature facilitates adjustment of the control arms to accommodate belts of any length.

Both lateral and radial adjustments of the pulley are effected through a patented tracking linkage, which is operated by a single tracking control arm. This feature provides precise ad-

Metal Buffing Process

Grav-i-Flo Corp., Dept. MF, Sturgis, Mich.

Known as Spin-Finish, the new process is said to eliminate the need for older hand and automatic buffing methods. The process, using a special-formula compound, produces surfaces and luster comparable to or surpassing that resulting from conventional buffing, it is claimed. It finishes a multiple mounting of parts in a single, automatically timed operation.

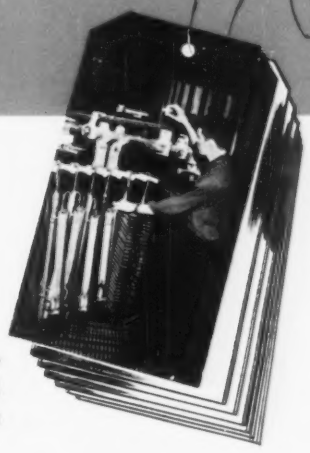
Advantages of the new process strike at several costly phases of conventional buffing methods. It eliminates, for one, the need for elaborate blowers and exhaust-ventilating systems. It is dust-free and fume-free; and whatever occupational hazard accompanies present buffing operations is eliminated as well.

The process is also stated to save buffing material costs. Parts unusual in shape which, under conventional methods, were difficult to process and meant increased costs for buffs and wheels, are finished in a single operation. One compound is used for all part shapes and sizes.

Brightest spot in the list of cost-saving advantages is in labor economies effected. In addition to running a number of like parts in a single setup, groups of as many as four different parts may be run simultaneously. A

From H-VW-M

10 important ways to keep metal finishing costs down



All the processes, supplies and equipment in H-VW-M's line have been designed for maximum efficiency and cost savings. But among this full line are a group of products and processes which – if they apply to your operations – can offer outstanding costs and labor saving advantages. Included in this group are high-efficiency electrical and processing equipment, unusual processes, and finishing supplies having unique advantages.

The scope of the exceptional H-VW-M products, described on the following pages, covers a wide range of plating and finishing operations of every type, and the likelihood is strong that several, or perhaps all, are applicable to your plating plant. By investigating all of them, you should strike just the process, equipment or supplies you need to effect very real economies in your operations.

HANSON-VAN WINKLE-MUNNING CO. MATAWAN, NEW JERSEY U.S.A. SINCE 1820

HANSON-VAN WINKLE-MUNNING COMPANY

MATAWAN, NEW JERSEY

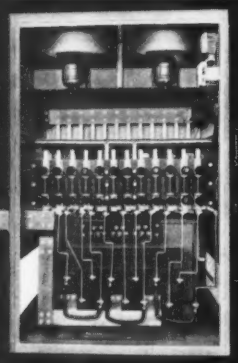
Manufacturers of a complete line of electroplating and polishing processes, equipment and supplies

Plants: Matawan, New Jersey • Grand Rapids, Michigan

Sales Offices: Anderson (Ind.) • Baltimore • Beloit (Wisc.) • Boston • Bridgeport • Chicago Cleveland • Dayton • Detroit • Grand Rapids • Los Angeles • Louisville • Matawan Milwaukee • New York • Philadelphia • Pittsburgh • Plainfield (N. J.) • Rochester • St. Louis San Francisco • Springfield (Mass.) • Utica • Wallingford (Conn.)

10 important ways to keep

ELECTRICAL AND PROCESSING EQUIPMENT



New Germanium Rectifier with panel removed to show simplified construction.

Manual Tap Switch Control

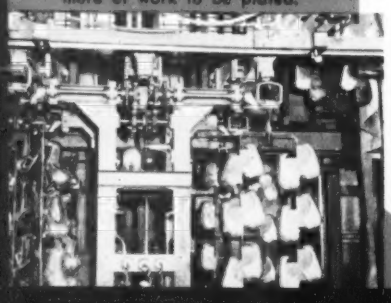
Motor Operated Tap Switch Control

Continuously Variable Auto-Transformer

Saturable Core Reactor

Operator is shown adjusting the Dial-A-Cycle mechanism that will determine the cycle for this rack of work.

Automatic loader-unloader has just removed two racks of plated bumper guards and loaded two more of work to be plated.



GERMANIUM RECTIFIERS

H-VW-M Germanium Rectifiers, known for efficiency, operating economy, compactness and close voltage control, are available in 6 to 150 volt capacity, with current outputs from 500 to 10,000 amperes. Designed for 24-hour-a-day operation at full capacity, with outputs of 12 volts or more, they have efficiencies up to 92%. Exceptional efficiencies are attained at ¼ and ½ loads. Voltage regulation as low as 5% can be obtained from no load to full load on some models at voltage ratings of 20 volts and above. Available with various types of voltage controls, manual or automatic, in self-contained or remote-controlled models.

Also look into the revolutionary new low cost line of Powertron Germanium Rectifiers—an H-VW-M first—with exclusive new features. These include: no-fuse DC protection system, no paralleling of junctions, high efficiency and improved regulation of germanium, 44 control positions with range of 2 to 12 volts, and less than 5% ripple. Available in ratings of 750 amperes, 1500 amperes, and 3000 amperes. Something special in packaged units and you get all the advantages at a new low price. If one of these fits your plating requirements, then you've got a real bargain. Immediate delivery. Write for catalog.

RECTIFIER CONTROLS

H-VW-M offers a complete line of rectifier controls to provide for many control functions. Used with either selenium or germanium rectifiers, these controls, properly applied, permit the most efficient control possible. Such devices as manual and motor operated tap switch controls, continuously variable auto-transformers and saturable core reactors are used with or without supplemental controls to provide automatic voltage stabilization, automatic current stabilization as well as automatic programming. H-VW-M Bulletins ER-108 and ER-109 further explain economical H-VW-M Rectifiers and Controls. Write for it.

FULL AUTOMATIC CONVEYORS

For well over 30 years H-VW-M design engineers have worked continuously for improvements in the automatic conveyors for electroplating and allied operations in which H-VW-M pioneered.

Today's full-automatic conveyors are a far cry from the conveyors produced by H-VW-M as early as 1922. But one thing remains the same—and that is H-VW-M's desire to provide the most advanced and efficient equipment possible. Scores of innovations and improvements resulting from continuing H-VW-M research mean today's H-VW-M Full Automatic Conveyors offer the ultimate in service and efficiency for peak production of the highest quality at lowest cost.

DIAL-A-CYCLE CONTROL

Exemplifying the many H-VW-M developments contributing better, easier plating, is the remarkable new DIAL-A-CYCLE Control. This unique selective by-pass mechanism—of particular interest to aluminum anodizers—permits a whole series of different operations and cycles in one full automatic conveyor. Length of any treatment time can be varied, and, in anodizing, different colors can be anodized in one continuous operation, and in any sequence. It is a truly revolutionary device, resulting in remarkable labor savings and increased production.

AUTOMATIC LOAD-UNLOAD

Automatic Load and Unload is another recent development of H-VW-M that contributes to greater economies in the plating room. This new transfer unit, operating the same indexing sequence between plating conveyor and a monorail conveyor loads and unloads racks automatically. Manual handling is eliminated by this major advance towards automation in metal finishing.

This, of course, is just one of many types of conveying equipment offered to metal finishers. Return type conveyors, elevator conveyors, high-lift conveyors, straight line conveyors, and others—of every description are H-VW-M designed, manufactured and installed. If you'd like to know more about the cost-saving story of H-VW-M Full Automatic Conveyors, write for Bulletin FA-105.

metal finishing costs down

BUFFING AND CLEANING SUPPLIES

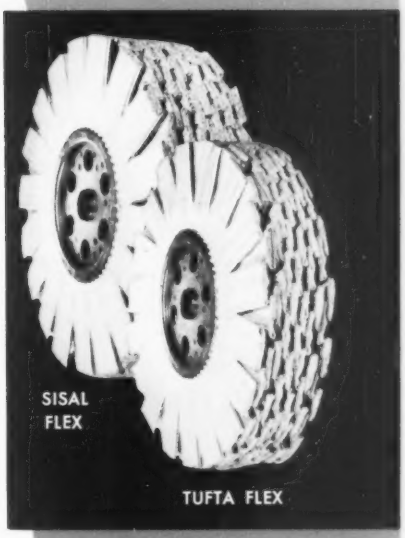
BUFFS

Tufta-Flex and Sisal-Flex Buffs

Speed and economy are embodied in two new H-VW-M Buffs for thorough cutting and coloring on contoured surfaces. For medium and heavy duty, SISAL-FLEX Buffs with sisal-cored tufts are available, and for light to medium duty, TUFTA-FLEX Buffs, having full cloth tufts, are offered.

Both buffs feature double-folded tufts for maximum cutting surface, and to retain compound on the leading edges and ends of the tufts. To prevent streaking, tufts are staggered in a double row around the buff. Cool running, a feature of both buffs, is the result of staggered tufts, plus a pattern of ventilating holes in the rugged steel center. Fraying, which is wasteful and expensive, is ruled out by the bias-cut construction of both cloth and sisal.

These time and cost-saving new buffs are available in standard diameters from 12 to 18 inches.



BINDERIZED® RUFF-L-BUFFS

"BINDERIZED" Ruff-L-Buffs are pre-treated with a high quality compound binder. Because every fibre is impregnated with the same binder used in buffing compounds, Binderized Ruff-L-Buffs are ready for operation at top efficiency from the very first piece.

The cost-saving advantages of Binderized Ruff-L-Buffs are many. "Heading-up" is eliminated, thus break-in time is radically reduced. Because of the natural affinity between the Binderized Ruff-L-Buffs and the compound, the compound lasts far longer, and is easier to apply. Naturally, much better cut is obtained because of the high amount of compound carried.

Perhaps the greatest advantage of Binderized Ruff-L-Buffs is their internal lubrication which prevents wear inside the buff (see photos). Wear is even—and up to 30% longer. To learn more about the unusual economies of Binderized Ruff-L-Buffs, write for Bulletin No. B-103.

Plain Ruff-L-Buff (below) after wearing off 1 inch in test. Loose threads, numerous holes and breaks due to excessive heat and abrasion are apparent.

Binderized Ruff-L-Buff (below) after same test. Notice absence of thread or cloth breakage, convincing proof of Binderizing's effect on buff life.

LIQUIMATIC COMPOUNDS

and application equipment

Buffs "live" up to 200% longer . . . No compound waste . . . Reduced labor costs . . . Fast cutting, easy cleaning—all these advantages and more are embodied in the unusual Liquimatic Liquid Compounds and application equipment.

Because of the enormous economies of using the Liquimatic System, the system soon pays for itself in buff, compound and labor savings.

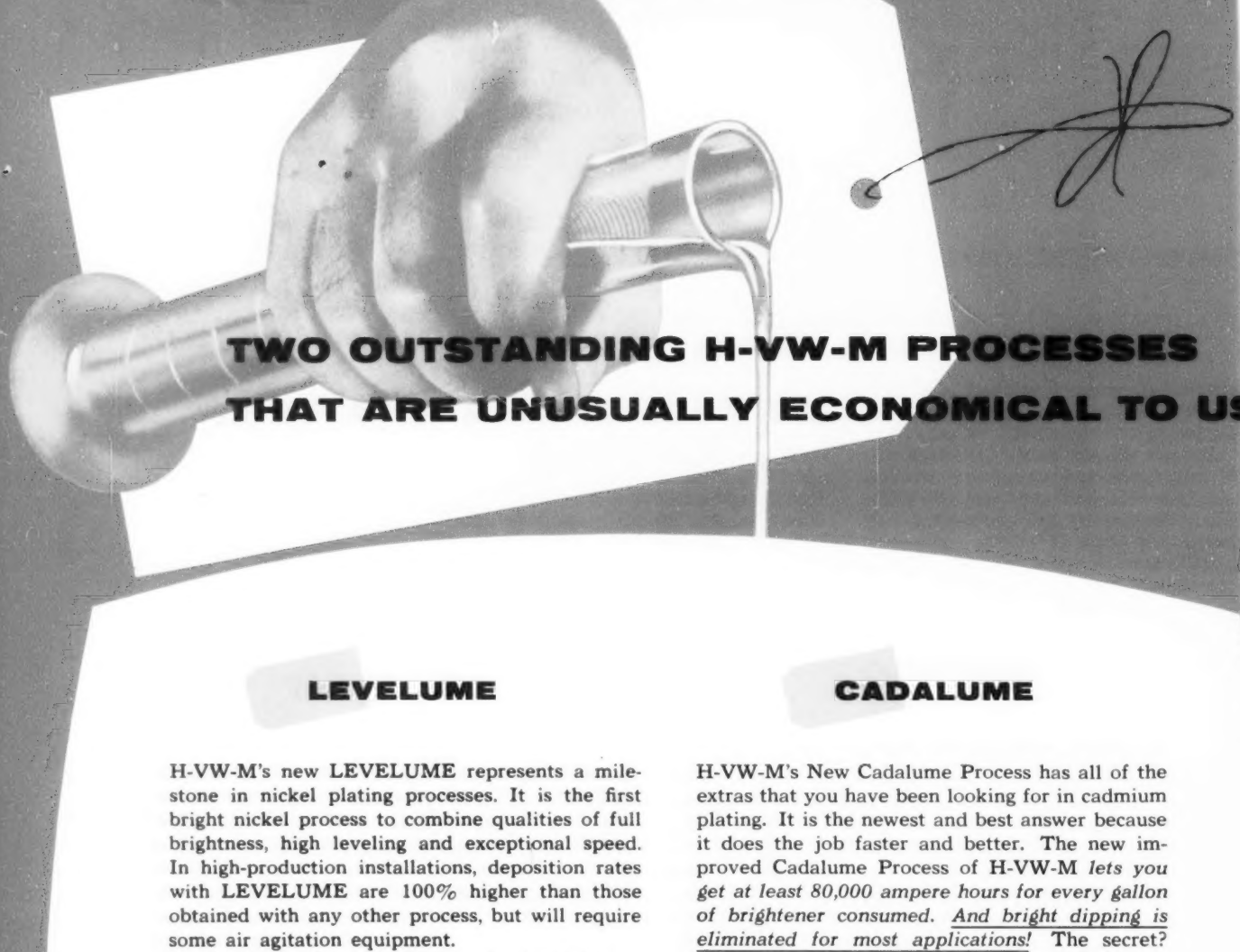
A complete line of Liquimatic Compounds is available for cutting and coloring ferrous and non-ferrous metals. These provide an adhesive, slow-wearing buff face, and have a high safety factor because of their high flash point. All are of sprayable viscosity, and have a long storage life. Write for H-VW-M Bulletin No. Co-103, which fully describes Liquimatic and other economical H-VW-M Compounds.

85-S ALUMINUM CLEANER

H-VW-M devotes constant research to the subject of cleaners and the result is a comprehensive line of Matawan Cleaners giving superior results in soak cleaning, power spray operations, oxide removal, and special cleaning and etching operations.

Of particular importance is H-VW-M's new 85-S Aluminum Cleaner, which offers interesting advantages to aluminum finishers. It prevents scale formation, for instance, thus keeping coil and tank walls scale free, and it leaves an extremely bright surface. Its built-in regenerator makes maximum effective use of caustic in the bath.

H-VW-M Bulletin C-108 tells about this unusual cleaner, and other Matawan Cleaners offering unusual money-saving advantages.



TWO OUTSTANDING H-VW-M PROCESSES THAT ARE UNUSUALLY ECONOMICAL TO USE

LEVELUME

H-VW-M's new **LEVELUME** represents a milestone in nickel plating processes. It is the first bright nickel process to combine qualities of full brightness, high leveling and exceptional speed. In high-production installations, deposition rates with **LEVELUME** are 100% higher than those obtained with any other process, but will require some air agitation equipment.

Conversion to Levelume is simple, involving no new investment in conveyors, or tanks.

Key to the new process are its addition agents. With them an activated carbon pack can be used in the plating solution filter. This constantly removes harmful organic contamiments, preserving the purity of the bath, and consequently contributing to the economy of the process.

A few of the additional benefits include high surface activity, good ductility, controlled stress, and the feasibility of double coatings. A full description of the process—one in the family of NICKELUME processes—is available in the Levelume Manual, which is available on request.

CADALUME

H-VW-M's New Cadalume Process has all of the extras that you have been looking for in cadmium plating. It is the newest and best answer because it does the job faster and better. The new improved Cadalume Process of H-VW-M *lets you get at least 80,000 ampere hours for every gallon of brightener consumed. And bright dipping is eliminated for most applications!* The secret? It's simply this: You use two different Cadalume Brighteners. One is the Cadalume Make-Up Brightener and you use it only when you make up a new bath or convert an existing one. The other —Cadalume Brightener—is the strong addition agent used for all maintenance.

Here's why Cadalume keeps your costs low: The bright range is increased up to 10% . . . you get very high plating speeds—up to 10% increase . . . 4 times longer bath life . . . better distribution . . . and the brightener is more stable—it won't plate out. This simple, easy-to-operate economy is something for you to see. Ask for the New Cadalume Technical Manual.

H-VW-M PROCESSES, SUPPLIES AND EQUIPMENT KEEP PLATING ROOM COSTS DOWN . . .

They're Always Your Best Buy!

SINCE 1820

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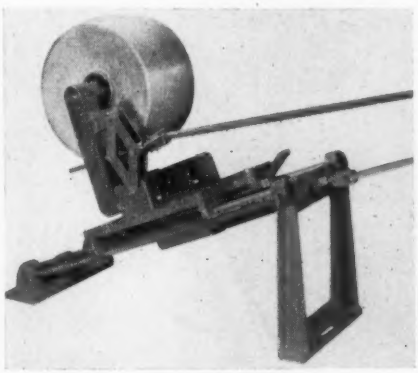
3627 Printed U.S.A.

justment of the pulley for all types and weights of belts from ½" to 6" in width. A leather boot (not shown in the photo) fits over the tracking linkage, protecting it from excessive wear as a result of dust, dirt and other foreign matter.

Belt tension is adjusted by means of the other remote control arm. A rugged, spring-loaded device on the idler makes possible a complete range of adjustments, from an accurately controlled light tension for narrow belts to a much greater tension for wide belts. The adjusting screw which controls this mechanism at the idler is protected by an accordion type neoprene boot.

The heavy duty aluminum alloy pulley is radially crowned for perfect trackage and prevention of wear. It is 10" in diameter and 6" wide. To insure perfect performance this pulley is dynamically balanced and is provided with sealed precision bearings. Shield caps protect the bearings from dust, dirt, abrasive particles, sanding refuse and belt grease. A zerk fitting is provided for greasing the bearing. Under normal use one shot of grease per week is the only maintenance required.



The sturdy, heavy-duty base of the idler not only gives maximum support and accessibility but also supports the idler in such a position relative to the contact wheel that it assures belt wrap-around at the proper position on the contact wheel for all operations. The idler can be mounted readily at any distance behind the polishing lathe as required by a belt of any length.

Total weight of the unit is 74 pounds.

72/Circle on Readers' Service Card

Chromate Conversion Coating

Kosmos Electro-Finishing Research, Inc., Dept. MF, 140 Liberty St., Hackensack, N. J.

Ker-Chro-Mite AL, a chromate conversion coating for aluminum and its alloys, is said to impart a yellowish protective coating on high purity aluminum, as well as on high silicon bearing alloys. The solution is a chromate type. It is a strong acid, and will attack the most stubborn oxides and imparts a protective coating.

The product is supplied in concentrated solution form and diluted up to 100 volumes for processing. The process is claimed to require little control for excellent results.

The attractive yellowish finish is an excellent base for paint or as a corrosion resistance final finish, according to the above manufacturer.

73/Circle on Readers' Service Card

Cartridge Heaters

General Electric Co., Industrial Heating Dept., Dept. MF, Schenectady 5, N. Y.

A complete new line of electric cartridge heaters, from 10 to 15 per cent lower in price than the previous equivalent units is stated to be suitable for a broad range of applications. Brass sheathed for maximum operating life, the heaters are rated at 35 watts per square inch of effective heating length.

Diameters available are ½-inch, in lengths from 2½ to 8 inches; ⅝-inch, in lengths from 2½ to 16 inches; ¾- and 1-inch, in lengths from 3 to 20 inches; and 1¼ inches, in lengths from

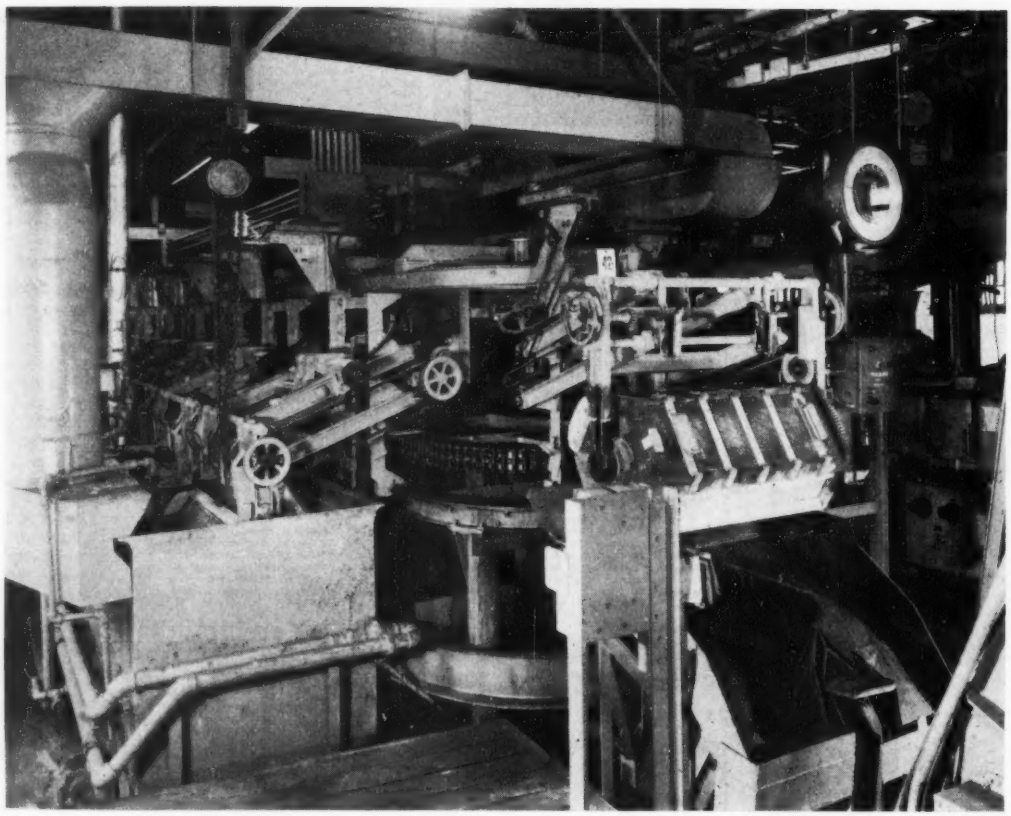
BAKER BROS., INC.

DEPENDABLE REBUILT METAL FINISHING EQUIPMENT

OFFERS FOR SALE

Udylite Return Type Full Automatic Horizontal Plating Barrel Conveyor

NEW — JUNE — 1955



Type of Plate: Zinc or Cadmium with bright dip cycle.
Overall Dimensions: 104′ long x 14′ wide x 10′ high.
Number of Cylinders: 42 — 16″ x 36″ Tempron.
Capacity: 40 barrels per hour, 400 lbs. maximum per barrel.
Condition: Like new, can be seen operating.

This machine is the latest in automation to hit the metal finishing industry. It combines production and the flexibility of allowing the deposition of metal in each cylinder to be varied. Labor today represents the largest portion of your costs. This machine is your solution for reducing your cost of labor.

UNIT AT FRACTION OF NEW COST

Auxiliary Equipment for Sale with or without Automatic

1—75 ton Chrysler Airtemp Refrigeration Unit
2—ILG BC-90 Heresite Lined Blowers
4—Bell & Gossett Coolers with 4 Stainless Steel Dumps
1—Ransohoff Double Skip Charging Machine
1—Ransohoff Drum type Hot Air Drier
2—Ransohoff Vibrating type Hopper Discharging Units
1—Udylite Hipper-Dipper Bulk Processing Machine
3—Chandeysson 4500 ampere, 18 volt Motor Generators
1—Chandeysson 3000 ampere, 24 volt Motor Generator
1—Chandeysson 6000 ampere, 24 volt Motor Generator
1—Chandeysson 7500 ampere, 18 volt Motor Generator
1—Chandeysson 3000 ampere, 9 volt Motor Generator
12,000 lbs. 4" x ¼" Copper Bus Bar

ALL OF THE ABOVE EQUIPMENT CAN BE SEEN AS OPERATED.

YOU NAME IT — WE HAVE IT

I. Two complete Straight Line Udylite Barrel Plating Units consisting of: Cleaners, Rinses, Acid Pickles, 5 station cyanide tanks and:

11 Udylite 14 x 36 Lucite Cylinders, ⅛" perf., dangler.
7 Udylite 14 x 36 Monel Cylinders, ⅛" perf.
1 Udylite Hipper Dipper Dichromating Unit, Hydraulic, 1955.
19 Udylite 14 x 36 Rinses, lined and unlined.
1 Ransohoff Spiral Dryer

AUTOMATION COMES TO BAKER BROS.

I. Hanson-Van Winkle Elevator type Full Automatic, built in 1951, just out of crate, unit built for cyanide plate, complete with auxiliary equipment.

II. Udylite Full Automatic Senior Nickel Chrome Machine, 61' long.

BUY WITH CONFIDENCE

OUR BUSINESS IS AS GOOD AS OUR REPUTATION

BAKER BROS., INC.

564 EAST FIRST STREET **SOUTH BOSTON, MASSACHUSETTS**

Phone: ANdrew 2-2535 - 6 - 7 - 8

4 to 24 inches. Wattages available vary from 100 watts in the smaller sizes to 2,000 watts in the largest size. Heaters with diameters below one inch are equipped with 10-inch flexible leads; diameter sizes one inch and above have ½-inch, 8-32 threaded solid stud terminals.

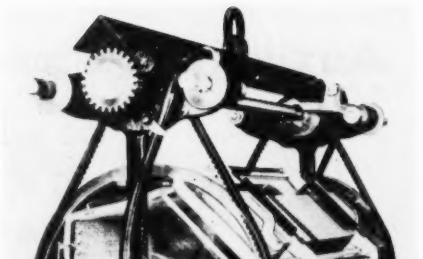
77/Circle on Readers' Service Card

Belt-Driven Plating Cylinder

Hanson-Van Winkle-Munning Co., Dept. MF, Matawan, N. J.

A new Mercil type barrel plating cylinder features a newly designed belt drive that simplifies and minimizes maintenance time and costs. It is driven by a standard cogged V-belt which eliminates the use of a series of gears. Because of the design simplicity there are no moving parts on the cylinder, eliminating wear and resulting parts replacement. The motor can be mounted on hanger superstructure to offer greater flexibility in use on existing equipment. Construction of the cylinder makes it suitable for use in any normal preparation or plating solution.

The barrel is designed for total submersion during the plating process, increasing plating speeds and insuring thorough plating action. Double flexible dangler contacts are used with the barrel, carrying current into cylinder through both ends and providing



greater plating capacity. Cylinder hangers are completely insulated from contacts and hanger pins. Dangler contacts are furnished with a removable control knob, with a rubber bumper attached for protecting the knob from hitting the panel section. The cylinder is bussed to carry 1,000 amperes.

Other design features reported for the new cylinder include: low maintenance costs; positive cylinder rotation, provided by stainless steel pins in the driving pulley; and a spring-type cover clamp to assure solid clamping and a tight cover throughout the plating process.

The cylinder is available in Plexiglas, Melamine and Tempron in all standard models and sizes. It can be interchanged with all present types of Mercil equipment. Plexiglas cylinders are molded in one piece and ribless in construction. Inside tumbling surfaces are convex to strengthen the cylinder and facilitate the tumbling action.

Melamine and Tempron cylinders are of conventional rib-type construction.

78/Circle on Readers' Service Card

Water Treatment Compound

Globe Compound Co., Inc., Dept. MF, Waterbury-Bristol Rd., Waterbury 12, Conn.

Monitor A is an organic compound which the above manufacturer claims to be a unique type of water softener, solubilizer, sequestering agent and stabilizer for numerous industrial, commercial and chemical products.

The compound is economical, effective and versatile. In dilute solutions it has little effect upon surface tension, and is non-foaming by itself, it is claimed.

79/Circle on Readers' Service Card

By-Pass Rotameter

Brooks Rotameter Co., Dept. MF, Lansdale, Pa.

The new By-Pass Rotameter is designed to permit economical measurement of large fluid flow rates in pipe sizes of 2" and above. It utilizes most of the inherent advantages such as: linear response, wide range (up to 10 to 1), direct reading scale, and ability to handle corrosive fluids. Among its many advantages are the elimination of overload checks, seal pots, and equalizing valves.

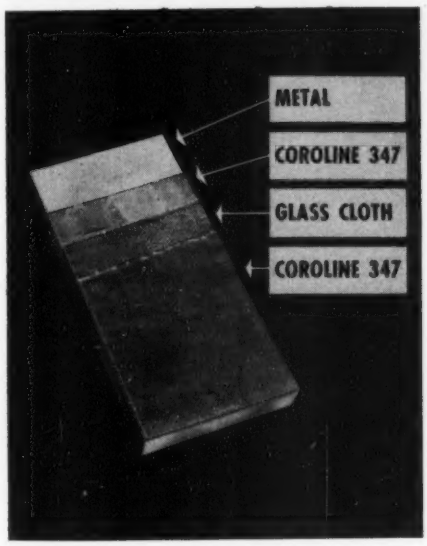
80/Circle on Readers' Service Card

Corrosion-Resistant Plastic Liner

The Homalite Corp., Dept. MF, 11-13 Brookside Drive, Wilmington 4, Del.

An epoxy base compound, called Coroline 347, for use wherever non-corrosive liners are required, is claimed to be inert to organic acids, dilute mineral acids, to caustics, alkalies, and most solvents. It has been used to line tanks, scrubbers, steamers, columns and ducts.

The product is composed of two parts which are easily mixed at time of application. It can be brushed or sprayed on and may be used satisfactorily in applying glass cloth or other fabrics. When more than one coat is required, successive applications may be made immediately. It has excellent adhesion qualities, can be applied on complex surfaces and hard-to-reach places as well as flat surfaces.



The plastic hardens at ambient temperatures in approximately 24 hours and does not require high temperature cures. Applications can be checked by high voltage spark testing.

81/Circle on Readers' Service Card

Airless Abrasive Blasting

Wheelabrator Corp., Dept. MF, Mishawaka, Ind.

A new size of Super Tumblast airless abrasive blast cleaning machine of the batch-type is for work that can withstand a tumbling action. It has an operating load capacity of 14 cubic feet.

A super-capacity abrasive-hurling wheel throws 830 pounds of abrasive per minute, or more than twice as much abrasive per minute as any similarly sized wheel previously used. The abrasive shower from the new super-capacity wheel spreads over the cleaning chamber in a uniform manner and cleans faster.

Wheel maintenance problems have been minimized by the use of newly designed blades that give twice the life of conventional blades, a strain-free blade holding device to reduce breakage and simplify replacement, a new easy-access wheel guard housing, and a new completely revised system of Long-Lyfe wheel guard liners.

The machine is available with either of two separators, one with super efficiency for foundry applications and the like, and another for less exacting requirements.

The unit has the tightest steel flight conveyor ever used in blast equipment. There are no areas where work, of even the smallest size, can jam and displace liners, interfere with the operation of

the door, or break the abrasive-tight seal on the machine, it is claimed.

The power-operated door is efficiently sealed and rigidly reinforced to keep abrasive from escaping the machine. It will withstand impacts from both inside and outside. It travels in tracks that are integral with the side frames of the machine. All high wear points are protected by Long-Lyfe liners of a special heat treated alloy steel that lasts 25 to 50 times as long as ordinary standard liners.

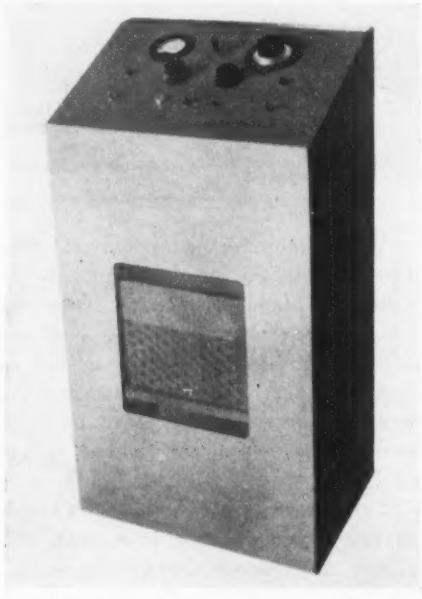
A single push button will actuate the entire sequence from loading to unloading, without the observation of an operator. In those cases where it is desirable to have an operator attending, he is free to handle more than one machine or perform other cleaning room tasks, also.

83/Circle on Readers' Service Card

Ultrasonic Generators

Gulton Industries, Inc., Dept. MF, 212 Durham Ave., Metuchen, N. J.

A new series of ultrasonic generators is designed to drive a wide variety of low-impedance ultrasonic transducers. Accenting an untuned output system and featuring 500 watt RF power output plus a varied range of frequency levels, these generators will be found useful for performing numerous techniques such as cleaning, chemical processing and soldering.



The series of generators, designated Glennite U-405, are blower cooled and operate at a nominal fixed frequency of 40 KC or at any frequency between 20 KC and 2 MC, depending on model.

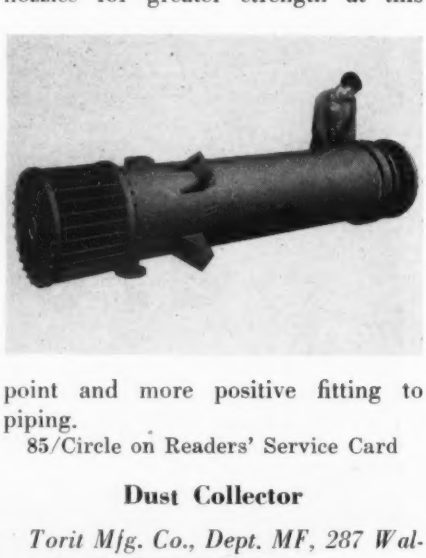
84/Circle on Readers' Service Card

Impervious Graphite Heat Exchangers

Falls Industries, Inc., Dept. MF, Aurora Road, Solon, O.

Impervite tube and shell heat exchangers are now furnished as standard in 14 and 16 foot lengths. These exchangers are produced from stocked component parts in sizes up to 650 tubes. The complete range of standard lengths now include 3′, 6′, 9′, 12′, and 14′ and 16′.

The new longer lengths provide greater economy of space for a given amount of heat transfer surface, and also increase the number of increments of transfer surface available as standard. In addition to the longer lengths, all standard tube and shell heat exchangers are furnished with flush end nozzles for greater strength at this



point and more positive fitting to piping.

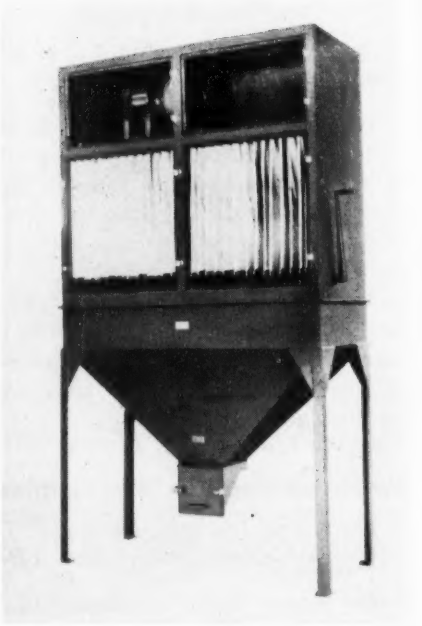
85/Circle on Readers' Service Card

Dust Collector

Torit Mfg. Co., Dept. MF, 287 Walnut St., St. Paul 2, Minn.

Designed to handle heavy-duty continuous grinding and other high dust volume sources is the new Model 123 dust collector, the largest cabinet-type collector now made by the above manufacturer. Handling as many as eight grinding wheels at a time, the Model 123 has a dust storage capacity of 10 cubic feet and a filter area of 300 square feet. Its 5 h.p. motor moves approximately 2,000 cubic feet of air per minute through an 8″ inlet at speeds of more than a mile a minute. Static pressure for this inlet is 3½″ water.

The welded steel cabinet is finished in baked gray enamel, and cloth filters for cool, quiet and efficient operation. Manual starter with overload protection is standard equipment, while explosion-proof motors and magnetic



starters are available at extra cost. If desired, the collector can be wired through the starter of the machine it serves, saving power by automatically starting and stopping with the machine.

Other specifications: height—115″; width—62¼″; depth—26″; shipping weight—1,130 lbs. F.o.b. factory price is $1,198.

86/Circle on Readers' Service Card

Organic Coating Applicator

American Agile Corp., Dept. MF, 5461 Dunham Road, Maple Heights, O.

A new concept in corrosion-resistant coating is a mobile, dual-purpose unit that provides both spray and dip or fluidized coating. The unit, known as the Mark III, consists of a metal reservoir hopper, 15″ in diameter, 24″ deep in the powder bed, with an overall height of 33½″, and with a maximum width dimension of 20″.

In operation, the device is effortlessly rolled by one man to its point of use. Connections are easily attachable to compressed air outlets throughout a user plant.

The unit can be used for both fluidizing (dip coating), and spray coating of finely divided polyethylene powders to metal targets. In addition, the fluidizing process offers even greater flexibility since, in addition to polyethylene, nylon and fluorcarbons can be utilized.

Offering the first mobile operations of this type, the unit rides on 6″ rubber-tired, ball bearing wheels. The unit comes complete with 15 feet of air and powder feed hose together with

an aluminum spray gun equipped with needle and control valves.

It is finished in a brilliant industrial green color. Control valves, handle and other fittings feature a highly chromed finish.

87/Circle on Readers' Service Card

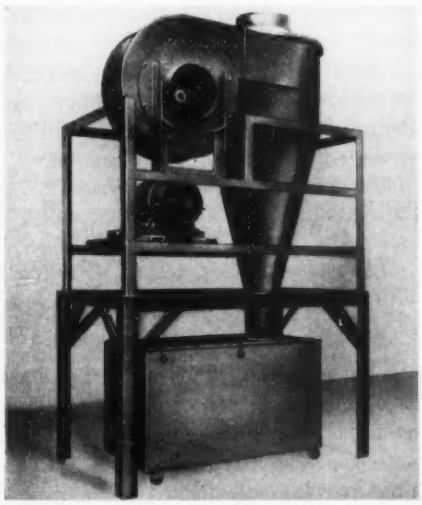
Dust Collector

Aget Mfg. Co., Dept. MF, Adrian, Mich.

This unit, known as the 90 NB 50 is designed for use in grinding, buffing, and miscellaneous operations where a large volume of dust, chips, shavings and other residue accumulates from manufacturing processes.

The special feature of the collector is the roll-away dust collecting bin, which has a storage capacity of 37½ cubic feet. This bin, of heavy reinforced cold rolled steel, moves on large rubber-tired ball bearing casters. It can be pushed to the dumping spot or it can be pulled out from under the collector where a forked lift truck can handle it. Bin top is held in place by luggage type clamps, and a flexible Neoprene coated hose runs from the cyclone outlet to the bin lid. The lid is lifted upward automatically by springs when clamps are raised.

This collector has an air handling capacity of approximately 10,000 c.f.m. and uses a 15 H.P. motor. The fan inlet will accommodate 15″ pipe. Overall dimensions are 48″ deep, 82″ wide by 124″ high. It is available for prompt shipment.



88/Circle on Readers' Service Card

Germanium Rectifiers

Hanson-Van Winkle-Munning Co., Dept. MF, Matawan, N. J.

A new low cost germanium rectifier incorporates major design innovations and improvements. Designed for small or big shop use in electroplating, anodizing and related processing, the Powertron rectifier is available in self-contained packaged models with ampere rating of 750, 1,500 and 3,000 amps. Voltage range extends from 2 to 12 volts. Built for volume production, the new rectifier sells for considerably less than the firm's standard selenium rectifiers of similar ratings.

Significantly new features include the use of new germanium junction diodes, and a DC protection system that requires no fuses. For these ratings, an arrangement of one germanium diode per phase is possible and there is no paralleling of junctions. This means

excellent balancing of diodes. While the conservative rating of diodes enable the unit to withstand momentary external short circuits, the no-fuse DC protection system provides the first really positive protection in germanium rectifiers against major external short circuits, continuous overload and internal failure, it is claimed. In addition, the system is not affected by heat from within or without, and voltage transients are slashed considerably.

Finer positioning and smaller steps of voltage control are provided with a new 44 position switch arrangement. Three tap switches and a voltage-level switch are conveniently located on the unit's front panel.

No aging, efficiencies up to 90%, and good voltage regulation, which are characteristic of germanium systems, are additional advantages. The new unit also gives less than 5% direct current ripple, which is unusual for a low cost rectifier, according to the company.

Specifications are shown below.

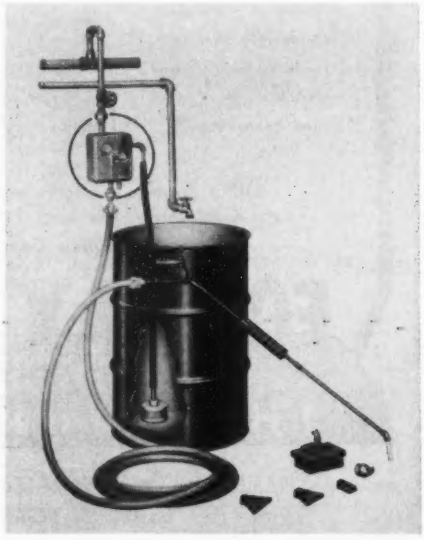
Prices are based on 440 volt 3-phase 60 cycle input. The prices (FOB Matawan) are slightly higher for 220 volt input.

750 amperes	2-12 volts	42″H x 22″W x 20″D	$ 995.00
1,500 amperes	2-12 volts	60″H x 24″W x 24″D	$1,490.00
3,000 amperes	2-12 volts	66″H x 33″W x 24″D	$2,695.000

91/Circle on Readers' Service Card

Steam Cleaner

Clayton Manufacturing Co., Dept. MF, El Monte, Cal.



A new steam cleaning unit weighing only 15 pounds is 44% lighter and 20% lower priced than previous models. This new model S-809 is the first to offer single valve control of hot cleaning solution plus a visual gauge constantly showing steam pressures. Extremely simple with no motor, pump or electrical connections, this 8½″ x 7″ control cabinet can be readily connected to any ¾″ valve steam outlet. That steam line, with pressure of 40 lbs. or more, supplies the only power required. Cleaning operations can begin immediately, without waiting for a warmup.

As shown in the cut-away illustration, cleaning solution is picked up in a metered amount by a strainer-protected suction head immersed in a drum or other recepticle, mixed and heated with live steam, and delivered in a driving spray through the gun nozzle. The single lever on the cabinet varies capacity from 120 to 190 g.p.h. of hot cleaning solution. This same valve also controls temperatures of the solution and velocity of discharge at the gun nozzle.

Upon completing one cleaning job, the control cabinet can be quickly disconnected from the steam outlet and easily carried to any other location in plant or yard, wherever steam is available. For easy portability, the drum of cleaning solution can be mounted on a swivel-caster pallet.

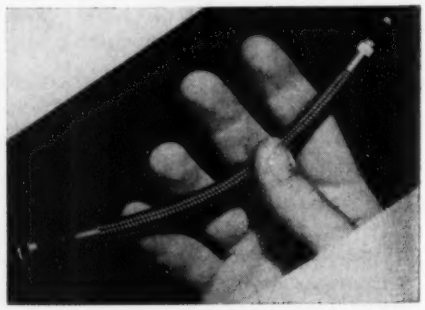
92/Circle on Readers' Service Card

Teflon Hose Assemblies

The Mic-Lin Co., Dept. MF, Route 38 at Rudderow Ave., Maple Shade 6, N. J.

The "Lin-Lok" line of Teflon hose assemblies consists of a Teflon liner encased in stainless steel wire braid with specially engineered full flow fittings permanently locked to the hose.

The units are capable of sustained



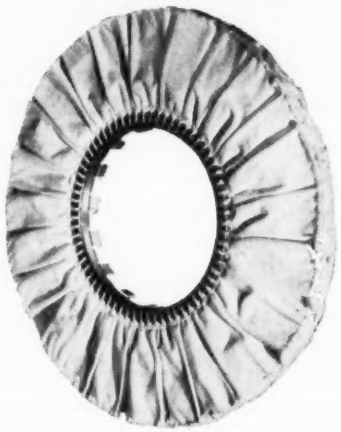
operating pressures up to 400 p.s.i. at temperatures from —100 to +500°F. and are recommended for use wherever maximum chemical resistance, freedom from contamination, wide temperature and pressure range, non-ageing, flexibility and ruggedness are prime requirements.

Eight sizes are currently available from stock, ranging from $\frac{3}{16}$" to $1\frac{1}{8}$" with a maximum length of 50 feet.

93/Circle on Readers' Service Card

Unsewed Cloth Buff

American Buff Co., Dept. MF, 2414 South La Salle St., Chicago 16, Ill.



Greater versatility of buffing on stainless steel, carbon steel and aluminum is claimed possible by the use of a new centerless unit cloth buff. Manufactured of superior quality cloth, the "units" of the new buff are left unsewed for softer polishing action. Unit edges are compactly folded upon themselves, giving a sturdy perimeter and leading edge that hold buffing compound longer.

The new buffs are available in a complete range of densities and sizes for any automatic buffing use.

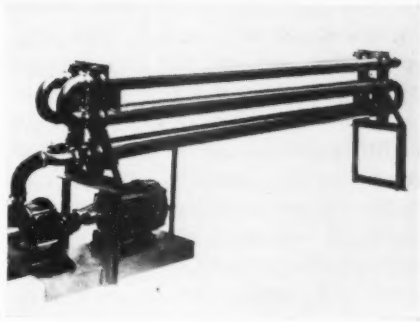
94/Circle on Readers' Service Card

Heat Exchangers

Carl Buck & Associates, Dept. MF, Essex Fells, N. J.

To heat and cool the new larger plating, anodizing and pickling tanks now being installed, the above manufacturer announces a new line of "Big Jobs." These units are composed of jacketed exchangers and proper capacity pumps on a single base to perform any heating or cooling job for metal finishing.

Exchangers utilize Karbate, steel, stainless, titanium or tantalum, depending on the corrosion characteristics of the various solutions. Camac pumps are made of acid proof plastic, cast steel or stainless to match the corrosion resistance of the exchangers.



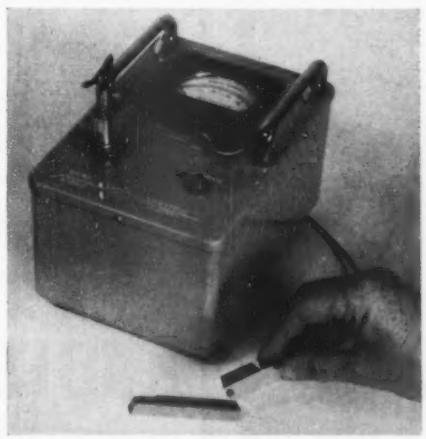
These new units are available in capacities up to 3,200,000 b.t.u. hr. in one unit and can be provided with built-in temperature controls for either heating or cooling.

95/Circle on Readers' Service Card

Surface Inspection Unit

Saratoga Scientific Co., Dept. MF, Box 488, Saratoga, Cal.

Designed for determining surface finish in micro inches by comparison or by direct measurement, this electronic instrument, called Micro Surfit, can be used on flat surfaces, rounds or holes. In operation, as the probe is stroked across the surface under test, a fine radius sapphire stylus translates minute surface irregularities into an electrical signal which is amplified, corrected and indicated on the meter of the instrument.

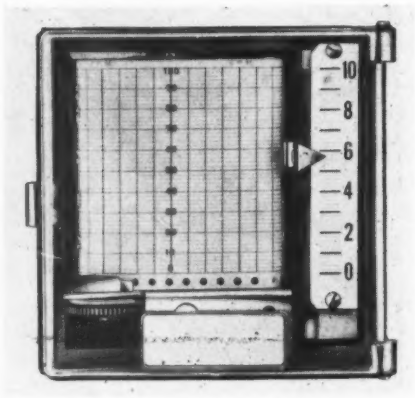


The meter is calibrated in micro inches. A special circuit is incorporated to minimize variations in reading due to differences in stroking speed. The unit has readings from 0 to 50 micro inches, 0 to 100 micro inches and 0 to 150 micro inches. Unit with one probe costs under $200.

96/Circle on Readers' Service Card

Recording Potentiometer

The Bristol Co., Dept. MF, Waterbury 20, Conn.



A new self-balancing electronic potentiometer gives a continuous record on a 3-inch strip-chart.

The new Dynamaster recorder, which uses standard components, is housed in a case only 5 inches square, to blend with other modern miniature instruments. Accuracy and sensitivity are unchanged from the standard 12-inch instrument.

The small-size self-balancing instruments are furnished in indicating models also. The indicating and recording chassis are both built for full plug-in service, and can be interchanged with each other in a matter of seconds.

Offered in either potentiometer or a-c bridge models, the new instruments can be used to measure and indicate or record any variable which can be converted into an electrical quantity, such as temperature, pressure, flow, speed, pH, smoke density, resistance, etc.

98/Circle on Readers' Service Card

Drum Sander

Diamond Saw Sales, Dept. MF, 120 N. W. Ninth Ave., Portland 9, Ore.

A 4" diameter Cone-Loc drum sander is now available for grinding, buffing and polishing operations with portable high speed grinders. This new, small diameter sander was added to the line in answer to numerous requests by large industrial plants for a precision balanced tool that could be operated at speeds up to 6,000 r.p.m. Weight of the new abrasive wheel is just one pound.

The device is a split drum sander made to accommodate ordinary strips of coated abrasives that can be torn off standard abrasive rolls. Abrasive strips, when used on the sander, will perform the same work as endless belt type grinders at a savings of approximately 75% in abrasive costs.

The new sander is now made in only one width, 1½". It is available with arbor hole diameters of ½", ⅝" or ¾". The rubber cushion is 50 durometer Neoprene which will run in oil, grease or other petroleum products. Price is $25.75 postpaid and deliveries can be made at once.

99/Circle on Readers' Service Card

BUSINESS ITEMS

Kosmos Electro-Finishing Research Moves

Kosmos Electro-Finishing Research, Inc., formerly of Belleville, N. J., has moved to 140 Liberty St., Hackensack, N. J.

A more extended program of re-

search in metal finishing will be conducted at the more completely equipped laboratory, with conversion coatings and addition agents to plating solutions taking most of the activity.

More thorough client service will also be possible, with *John Kosmos* doing the consulting.

Speed-D-Burr Equipment Now Available Through 3M Distributors

In a move designed to offer more complete national sales and service, *Speed-D-Burr Corp.*, Glendale, Cal. manufacturers of precision barrel finishing equipment and supplies has announced an agreement with *Minnesota Mining & Mfg. Co.*, St. Paul, Minn., makers of "Honite" brand barrel finishing supplies, to distribute the complete line of equipment manufactured by Speed-D-Burr through the broad network of distributors now operating under the 3M banner.

3M distributors in Buffalo; Chicago; Chicopee, Mass.; Cincinnati; Detroit; Hazel Park, Mich.; Los Angeles; Minneapolis; Newark; Philadelphia; Providence; Roanoke; St. Louis; San Diego; Sanford, N. C., and Stratford, Conn. will supplement the present Speed-D-Burr organization now covering other key areas. The new association will bring to the 3M group the latest, most modern and most complete line of barrel finishing equipment available and will enable them to offer a wide variety of on-the-spot services in engineering, processing and technical information as well as the best in equipment and supplies.

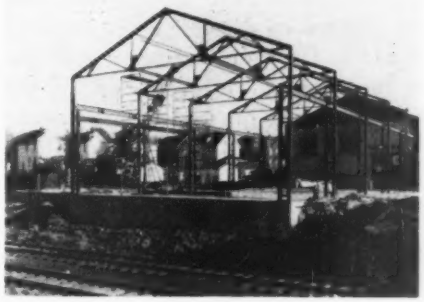
Chicago Rubber Increases Facilities

New production facilities that will enable substantial price reductions on a variety of industrial rubber products recently have been installed at *Chicago Rubber Co.* The firm is relocated at a plant with newly installed modern equipment at 651 Market St., Waukegan, Ill. They formerly were at 2620 Clybourn Ave., Chicago.

The company, which makes contact wheels and rolls for use with abrasive belts, is establishing production line operations for several items with high demand. It will continue its custom shop operations.

Price reductions as high as 30 per cent will result from the new installations, according to the firm.

American Plating Adds to Plant



American Plating, Inc. is building a major addition to its 10,000 sq. ft. plating plant at Zelienople, Pa. Plant space will be enlarged by 80 per cent.

Utilizing zinc, hard chromium, cadmium and other metals to plate small and very large products, the company now serves over seventy industrial firms in Western Pennsylvania, Northern West Virginia and Eastern Ohio.

Diamond Alkali Appoints Holder

Appointment of *Thornton F. Holder* to the post of director of research for *Diamond Alkali Co.*, Cleveland, Ohio, was announced recently. The appointment is effective immediately.

Holder replaces *Dr. Albert W. Meyer*, who has resigned from his present position as director of exploratory research. Dr. Meyer plans to continue in the field of chemical research. He will announce his plans in the near future.

In addition to taking over direction of the firm's exploratory research program, Holder will continue to be responsible for its patent and trade mark activities and supervision of general-purpose research facilities and operations otherwise unassigned. He will also continue to assist the president of the company in coordinating research efforts with the activities of its various operating divisions and other organizational units.

Mr. Holder joined the company in 1946 as patent counsel, and eight years later was named research coordinator and patent counsel. Previously, from 1943 to 1946, he was an officer in the U. S. Navy on special assignment to the wartime atomic energy program. From 1937 to 1943, he was associated with Moses & Nolte, Patent Attorneys, New York.

Thornton F. Holder

A graduate of Wesleyan University, Middletown, Conn., with the degrees of B.A. and M.A. in chemistry, Holder earned his LL.B. degree in 1938 from Fordham University, New York. He is a member of several national technical societies and associations, including the American Chemical Society, American Association for the Advancement of Science, American Patent Law Association, and the Armed Forces Chemical Association.

International Nickel Increases Nickel Price

Simultaneously with the announcement by *The International Nickel Co. of Canada, Ltd.*, of its new project in Manitoba for a major increase in nickel production, the company announced that, in order to deal with higher costs and facilitate maximum production, it is increasing the price of refined nickel by 9½ cents (U.S.) per pound effective December 6, 1956. Similar increases were announced by the company's United States subsidiary, *The International Nickel Co., Inc.*, and its United Kingdom subsidiary, *The Mond Nickel Co., Ltd.*

This brings the export price of elec-

trolytic refined nickel, from the Port Colborne, Ontario, refinery to 74 cents (U.S.) per pound including the 1¼ cents U. S. import duty which is paid by the company. At existing exchange rates the corresponding price in Canada will be 70 cents per pound Canadian currency.

Fuelling Joins Diamond Alkali

Appointment of *Charles L. Fuelling* to the technical sales staff of *Diamond Alkali Co.'s Chromium Chemicals Division* was recently announced.

Widely known in the electroplating and metal-finishing industry, Fuelling comes to the organization from Detrex Chemical Industries, Inc., Detroit, where he has been engaged in technical service work on phosphates and alkali compounds for the past two years. He will make his headquarters at the firm's research center in Painesville. Fuelling's production experience includes two years as a finishing consultant, several months as plating foreman for Advance Plating Co., Cleveland, and a similar period as finishing superintendent for Roller-Smith Corp., Bethlehem, Pa. For two years he also was assistant foreman of the plating and galvanizing department at American Steel and Wire Co., Cleveland.

Charles L. Fuelling

From 1946 to 1953, Fuelling was associated with the Plating Division of The Harshaw Chemical Co., Cleveland, in a technical sales and service capacity at Philadelphia.

A native Clevelander, Fuelling is a World War II veteran, having served in the U. S. Army as an officer from September, 1942 to February, 1946. Graduated in 1938 with an A.B. degree from Wittenberg College, Springfield, he is a member of the American Electroplaters' Society, American Chemical Society, and American Ordnance Association.

Alpha Metals Completes Chicago Expansion

Alpha Metals, Inc. has announced the opening of a new sales and manufacturing division in Chicago, Ill.

The new plant, at 2250 S. Lumber St., will be known as the *Alpha-Loy Corp.* In charge of the new organization will be *Harold Cohn.*

Stutz Appoints Carr

George A. Stutz Co. announces the appointment of *Louis E. Carr* as sales and service engineer in the Wisconsin-Minnesota area.

Mr. Carr is a registered engineer and a graduate of Purdue University. He

Louis E. Carr

has been engaged in sales work in the metal finishing field for several years and is well known to the trade in the area that he will be covering.

Previous experience also includes a year as plating supervisor for the Rutenber Electric Co. of Marion, Ind.

United Smelting & Refining Moves

The *United Smelting &Refining Co.*, manufacturers of anodes for the plating industry, have moved to their new quarters at 2920 W. Carroll Ave., Chicago 12, Ill.

Ransohoff Appoints New Engineering Head

The appointment of *Bernard S. Reckseit* as chief engineer is announced by *Ransohoff, Inc.*, Hamilton, Ohio, manufacturers of metal cleaning and finishing equipment and systems.

Mr. Reckseit, a native of New York City, is a graduate of The Massachusetts Institute of Technology and has served as a mechanical engineering consultant to industry. He joined the firm in 1947 as engineering assistant to the president, and assumes his new position following the death of *Nathan Ransohoff*, founder, chairman of the board and chief engineer.

Mr. Reckseit is a Registered Professional Engineer with extensive background in the design of metal cleaning and finishing equipment. He is active in The American Society of Mechanical Engineers, The National Society of Professional Engineers and The Cincinnati Engineering Society.

Bernard S. Reckseit

New Representative for Pioneer Rubber

James Alpine, of Ashtabula, Ohio, has been appointed as the new *Pioneer Rubber Co.*, manufacturer's representative for the East Northcentral area.

Mr. Alpine, who was formerly associated with McMaster Sales Co., Geneva, Ohio, will represent Pioneer in

James Alpine

Ohio, Michigan, West Virginia, Pittsburgh and surrounding area.

Buffing Compound Reclaim Service

A new service project for the buffing industry for 1957 has been added to *McAleer Mfg. Corp.* facilities. Buffing compound nubbins are being reclaimed and recast by a new division of the company.

Nubbins are shipped to a separate plant especially set up to remelt and recast discarded nubbins and bar ends. Automatic and hand bars are usually discarded when 15% to 20% of the bar material is still usable. The Remelt & Recast Division renews worthless compound bars at a fraction of original costs.

This division of the firm is housed at a different location in order to keep the operations separate from the production of new compound bars.

Cunningham New Dallas Sales Manager for Kelite

Lawrence W. Cunningham has been appointed Dallas district sales manager for *Kelite Corp.*, manufacturers of industrial chemicals and steam cleaning equipment.

Mr. Cunningham was formerly associated with Oakite Products, Inc. as technical service representative. His background includes experience in the petroleum and petro-chemical industries.

Mr. Cunningham is a member of National Association of Corrosion Engineers, American Petroleum Institute, and American Ordnance Association.

Lawrence W. Cunningham

Federated Metals to Build Big Secondary Aluminum Plant

Federated Metals Division of *American Smelting and Refining Co.* has announced that it will begin construction of a large secondary aluminum smelter at Alton, Ill. The plant, which will have an annual capacity of 72,-

000,000 pounds of aluminum alloy ingot, will double the company's present aluminum alloy production. It will be among the largest plants ever built to handle aluminum scrap metals.

To handle the output of the new smelter, new sales and purchasing divisions will be established at Alton. Sales engineers, specializing in aluminum applications, will cover the midwest and southwest. A special purchasing organization will acquire the large scrap tonnages required.

Construction of the new Alton smelter will begin in early 1957. When capacity is reached about one year later, Federated will be the world's largest smelter of secondary aluminum, according to the company.

Ott New Tech. Sales Rep. for Heatbath Corp.

Heatbath Corp. announces the appointment of *Gerald Ott* as technical sales representative in Eastern Ohio and Western Pennsylvania. He will work out of the office and warehouse at 3540 Croton Ave., Cleveland 15, Ohio. Teelphone Henderson 1-4900.

Mr. Ott is a graduate of Kent State University and, prior to joining the firm, was superintendent of Aircraft Plating Co. in Cleveland. He is a member of the A.E.S. and is well known in the Cleveland area.

The company also announces the transfer of *James B. Wheeler* to the Dayton-Indianapolis territory, which includes Western Ohio, Indiana and Northern Kentucky. Mr. Wheeler has been working in the Cleveland territory for the past year and will continue to supervise sales in that area.

Prior to joining the firm in 1955, Mr. Wheeler had 10 years experience in metal finishing and heat-treating, first as superintendent of Elyria Plating Co. and later as service repreesntative for Chemical Supply Co. in Cleveland.

Pennsalt Acquires Delco Chemicals

The boards of directors of *Pennsalt Chemicals* and *Delco Chemicals, Inc.*, Los Angeles, have approved a plan under which Pennsalt will acquire Delco. The acquisition will be accomplished through an exchange of stock.

With a new main plant and office

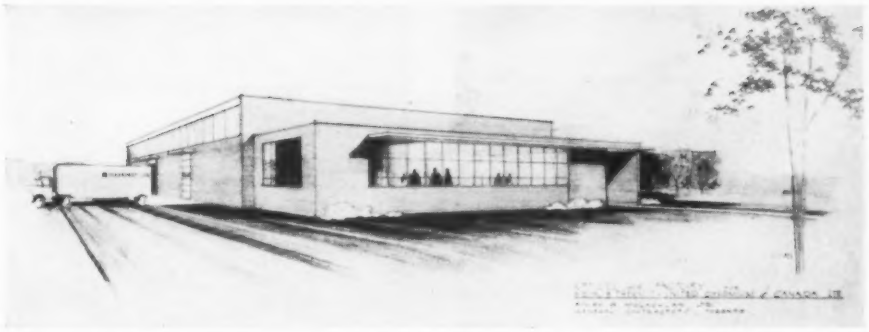
located in Los Angeles and another recently constructed plant at Dallas, Texas, Delco's major activities are the manufacture and sale of organic and inorganic specialty cleaning and paint stripping compounds for the aircraft industry and for general maintenance purposes.

Reciprocally, services provided by Pennsalt's plants, warehouses and sales offices throughout the northwest, central and eastern areas will facilitate the distribution of Delco's products and ensure efficient customer service for these products on a national scale.

Following transfer of ownership and control, Delco's operations will continue under the immediate direction of its president, *Lyle Harbour*, and its vice-president and general manager, *A. F. Slover*, and their associates. Delco's activities will become an integral part of the Chemical Specialties Division of Pennsalt under General Manager *Albert H. Clem*.

Metal & Thermit Completes Canadian Operations Center

The new combined office, warehouse and manufacturing facility of *Metal & Thermit—United Chromium of Canada, Ltd.*, under construction during most of 1956, has been completed. Production equipment is being installed and manufacturing operations at the new center will be in full swing by the end of December.



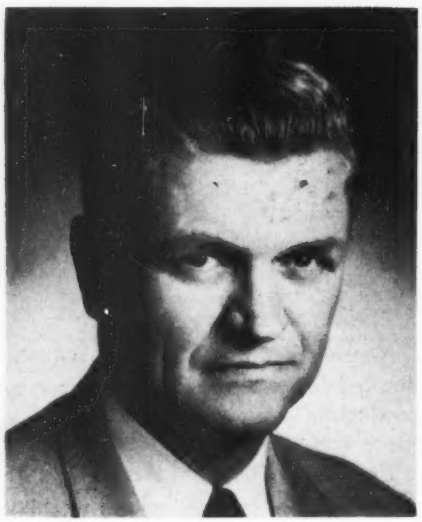
The new structure is located on a four-acre tract on Factory St. in the Highbury area of Etobicoke Township in northwestern Toronto. The building, a one and a half story structure, is 80 by 140 feet in size; it is of cinder block construction faced on two sides with brick and is served by both express highway and the Canadian Pacific Railroad.

Sixteen hundred square feet will be devoted to office space, the balance to production equipment, warehouse space and boiler room.

Products to be manufactured at the Toronto plant will include chromium, copper and nickel plating materials, liquid dips, organic protective coatings and welding compounds. The warehouse stocks will permit carrying ample stocks of the company's other products, and will result in faster service to Canadian users.

Metals Disintegrating Appoints Noel and Kuwashima

Don O. Noel has been appointed assistant to the president, and *Terry M.*



Don Noel

Terry Kuwashima

Kuwashima has been engaged as a development engineer, of *Metals Disintegrating Co., Inc.*, Elizabeth, N. J., manufacturers of metal powders, metal pigments, metal abrasives, pulverizing, air conveying and dust collecting equipment.

Mr. Noel studied at the Montana School of Mines, and is a graduate of the Columbia University's School of Mines. He is well-known in the metal powders field, and rejoins the firm after an absence of eight years. He originally joined the company in 1929, and over a period of years his activities included research, production, sales and engineering. He was chief engineer when he left the company in 1948 to join the Wah-Chang Smelting and Refining Co. Since 1952, he has been vice-president of the General Metals Powder Co., of Akron, Ohio. In his new work at MD, Mr. Neol will be in overall charge of plant operations in connection with the company's various plants throughout the country.

Mr. Kuwashima, who takes up duties in connection with the development of various products, is a graduate in chemical engineering of Syracuse University. In 1952, he joined Vitro Corp. of America, in New York City, as process design engineer. In 1954, he became a project engineer at Picatinny Arsenal, at Dover, N. J. Subsequently, he has been a research assistant at Syracuse University Research Institute.

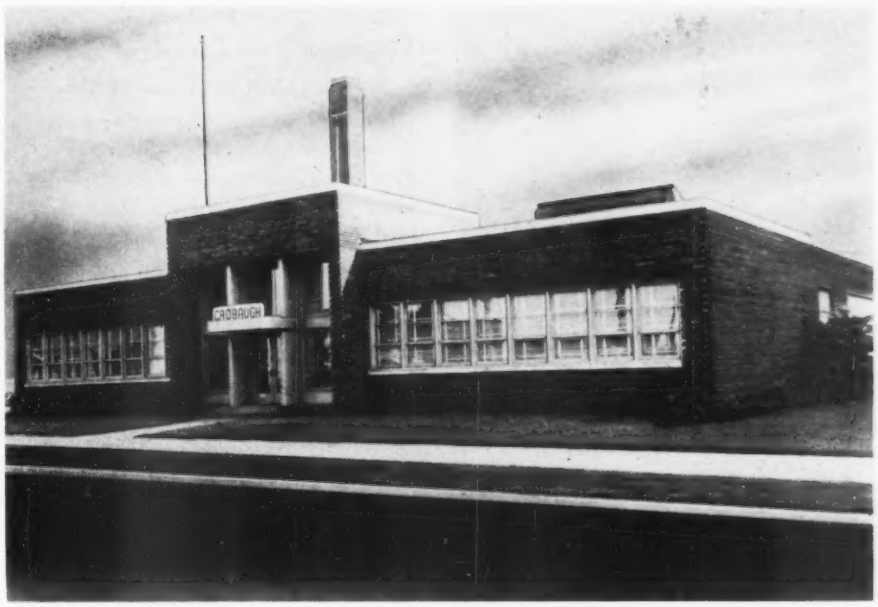
Schmidt Joins Stokes Field Sales Staff

Ronald W. Schmidt has joined the field sales staff of *F. J. Stokes Corp.*, Philadelphia, Pa., and has been assigned to the district office in Union, N. J., to serve customers in the Northern New Jersey area.

A native of Ridgewood, N. J., Mr.

Schmidt received his B.S. in chemical engineering from Syracuse University in February, 1951, after three years of service in the U. S. Navy during World War II. Following his graduation, he joined the pharmaceutical sales staff of the Chas. Pfizer Co. and, while working in Philadelphia, attended evening sessions of the Wharton School of Business and Finance for two years. He then became a sales representative for the Arthur Colton Co. in New Jersey and upper New York State, and a year later went with the J. H. Day Co. in New York in a similar capacity.

Mr. Schmidt is a member of Lambda Chi Alpha, and is active in the Ridgewood Post of the American Legion and in Syracuse alumni affairs.



Crobaugh Laboratories Moving to Larger Quarters

Crobaugh Laboratories are moving to new larger quarters in order to adequately serve their customers. The new building at 3800 Perkins Ave., Cleveland 14, Ohio, has over 10,000 square feet of laboratory space with an additional 20,000 square feet of land for future expansion. The building was built 12 years ago by the Atomic Energy Commission. A subterranean isotope vault is included in the building.

The firm, established in 1894, formerly operated in rented quarters at 1426 W. Third St. Complete chemical, spectrographic, organic, physical and X-Ray facilities are available. The company acts as consultants to the metal finishing trade, process industries and foundries. *Henry R. Friedberg*, past president of the Cleveland Branch, AES, is technical director."

Receive Wyandotte Chemicals 25-Year Watches

Two more Wyandotte Chemicals

representatives recently received 25-year service watches. At left is Cleveland District Sales Manager, *Fred Troxell;* at right is New York City salesman, *John Pryor*. Congratulating the two men is *Fred Tholen*, sales manager, who has already received his 25-year watch. Nearly 2100 service watches have been awarded by the company. Messrs. Troxell and Pryor are among the 857 employees who wear 25-year watches and are still in active service.

Acoustica Elects Paul M. Platzman Vice-President

The board of directors of *Acoustica Associates, Inc.*, Glenwood Landing, N. Y., has announced the election of *Paul M. Platzman* as vice-president of sales and manufacturing. The firm, a leading manufacturer of ultrasonic equipment, also announced the appointments of *Harold P. Baker* to the position of vice-president and treasurer, and *Ralph Reynolds* as technical sales manager.

Mr. Platzman was formerly manager of the public relations department, John Mather Lupton Co., Inc. He is a graduate of Georgia Institute of Technology, class of '43, where he majored in mechanical and electrical engineering. His military experience includes tours of duty in World War II as an anti-aircraft artillery officer and battery commander, specializing in fire control systems and radar, and later as anti-aircraft advisory officer assigned to the 1st AAA Guided Missile Battalion, White Sands, N. M., where he participated in the development of a Table of Organization and Equipment for the newly conceived guided missile battalions.

Paul M. Platzman

Mr. Baker is a Certified Public Accountant most recently associated with Arthur Young & Co. He holds a B.S. and M.S. in Business Administration, Columbia University.

Mr. Reynolds was formerly connected with the Kelite Corp., engaged in technical service and sales of metal processing chemicals. Following graduation from the University of Wisconsin in 1947 with a B.A. in Chemistry, Mr. Reynolds did graduate work in chemistry and mathematics at the University of Wisconsin and Temple University, respectively. From 1948 to 1953 he was employed as a research chemist in the Research and Development Laboratories of Socony-Mobil Co., Inc.

Chemical Corp. Assigns Representative

In a realignment of territories *The Chemical Corporation* has assigned *Armand W. Faucher* as sales and technical representative in central and northern Connecticut, calling on the metal finishing trade.

Mr. Faucher is a resident of West Hartford and has a full background in metal finishing chemistry. He attended the University of Connecticut and took special courses at Yale. His twenty years experience in the laboratory as an electrochemist at Underwood Corp. was followed by two years as chief chemist at Royal Typewriter. He has

since served the Chemical Corporation as a chemist and technical service man, fitting him admirably for his latest assignment.

Well-known in the plating industry, Mr. Faucher, is an active member of the American Chemical Society, The Electrochemical Society, American Society for Metals, the Institute of Metal Finishing, the Faraday Society and the American Electroplaters Society. He is currently Educational Advisor of the Hartford Branch A.E.S.

Fielden to Occupy Larger Sales Quarters in Cleveland Area

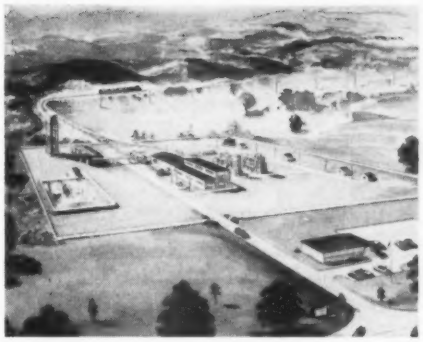
The Cleveland, Ohio, sales engineering staff of the *Fielden Instrument Div., Robertshaw-Fulton Controls Co.*, has moved to larger quarters at 6116 St. Clair Ave.

The Fielden sales group will share the new quarters with other divisions of the company, and will vacate offices located at 3091 Mayfield Rd., Cleveland Heights.

Harold N. Gilmore, formerly with Goodyear Aircraft Corp., has been named to head the sales staff in the Cleveland office.

Metal & Thermit Will Build Chemical Plant in Kentucky

Metal & Thermit Corp., New York, the country's largest producer of tin



chemicals, has purchased a 163-acre site near Carrollton, Ky., and will soon begin construction of a new chemical processing plant.

The 163-acre tract which the firm has acquired is located one mile east of Carrollton, on U. S. Route 42. The initial development of the property will cover ten acres of the tract. and will include an office building, a warehouse building and a steam plant as well as the production buildings and several minor structures. At the start of operations the new plant will employ 30 to 35 persons.

Beckman Buys Watts

Beckman Instruments, Inc., has announced the acquisition of *Watts Mfg. Co., Inc.*, Ronceverte, W. Va., manufacturer of a new, continuous-action gas chromatograph, an anlytical instrument destined for an increasingly important role in modern industrial process control.

Dever Named to Top Post at Honeywell

Henry F. Dever, president of *Brown Instruments Div.* of *Minneapolis-Honeywell*, has been given corporate responsibility for directing the parent company's activities in the industrial controls field. He will be responsible for the over-all planning in the industrial controls field and will counsel and coordinate the engineering and manufacturing operations of seven divisions now active in this field. Dever will continue to head up the Brown Instruments Division and will make his headquarters there. *C. L. Peterson*, vice-president and general manager of the division, will direct its daily operations.

Dever, a 30-year man with the firm, was vice-president in charge of engineering in Minneapolis before moving to Philadelphia to head up the Brown division. He is also president of the Scientific Apparatus Makers Assn.

Trane Lists Manager Change in Cincinnati

Richard A. Matheis has been promoted to manager of *The Trane Co.* sales office in Cincinnati. The new 33-year-old manager has been with the firm since 1947.

After completing an accelerated company Student Engineering "post-graduate" course, Matheis was assigned to the home office sales staff in La Crosse, Wis. In April, 1952 he was transferred to the Pittsburgh office where he served as field sales engineer until his high-level managerial appointment.

He is an industrial engineering graduate from Lehigh University in Bethlehem, Pennsylvania, a member of the professional engineering society ASHAE, Tau Beta Pi and Pi Tau Sigma.

Associations and Societies

AMERICAN ELECTROPLATERS' SOCIETY

New York Branch

The New York Branch will hold its Annual Educational Session and Banquet at the Hotel Statler, New York City, on Saturday, March 2, 1957.

The technical session will be held at 2:30 P.M. The speakers will be: *Cleve Nixon*, head of Electrochemistry Div., General Motors Research Labs., Detroit, Mich., "Conservation of Nickel in the Plating Room"; *Leonard Chesworth*, Chief Chemist, United Carr Fastener Corp., Cambridge, Mass., "Modern Trends in Barrel Plating"; *Dr. Henry Brown*, head of Research, Udylite Corp., Detroit Mich., "Surface-Active Agents in Plating."

Newark Branch

The November meeting of the Newark Branch was held on November 16th with President Struyk presiding.

Following the presentation of the movie "Bright Steel" by *Howard Cobb* a business meeting was held at which time *George Ross* and *Robert Groom* of Bart Manufacturing, *Arthur Ellsworth* of Breeze Corporation, *Hee Taek Yum* of Seoul National University (Korea), *Wilbur McBurney* of Geigy Chemical Co., *Kenneth Rau* of Magna Plate, *David Philipse* of Feders-Quigan, and *Alfons Latawiec* of Westinghouse Electric Corporation were elected members. The nominating committee, *Eugene Wagner*, chairman, Frank England and *Thomas Austin* placed the following in nomination for delegates to Interim and Montreal meeting of the Supreme Society:

Delegates: *Howard Cobb*, *Donald Foulke*, *George Wagner*.

Alternates: *Dodd Carr*, *Robert Horrocks*, *Gerald Lux*, who were duly elected.

William Grigat then reported on the Christmas Party to be held on December 15th urging all to attend the social function and the educational session on the 14th.

Dodd Carr then introduced *Kenneth Irgens* of Hanson-Van-Winkle-Munning Company who took as his topic "Cleaning and Etching of Aluminum" reviewing the various methods for treating aluminum, emphasizing alkaline etching and the methods for preventing scale formation. The chief speaker of the evening was *N. L. Miller* of Turco Products, Inc., who discussed the Chem Mill process in some detail after showing a movie of the process in action. The extreme interest in the process by the 75 in attendance was shown by the numerous questions after the talk.

D. Gardner Foulke
Secretary

Indianapolis Branch

Forty members and guests attended the November 7 meeting at Fox's Steak House, Indianapolis. After the usual introductions, *Marshall Whitehurst* presented a past president pin to *Herb Kennedy*. Minutes of the October meeting were read and accepted. *John Holland's* treasurer's report was accepted as read. The Branch was host to *Herberth Head* of the National committee.

Addison Howard, reporting for the

committee on the branch "paper," announced the title "The Plating of High Density Tungsten Base Powdered Metal Alloys" as a work by *G. R. Van Houten* and *Dave Sivertsen*. A motion was made by *Bert Hawhee*, seconded by *Les Reynolds*, and carried, that the Branch accept the title reported by the paper committee and authorize them to proceed.

Nominations for delegates and alternates resulted in the following. *John Hood*, *John Holland*, and (secretary) *Paul Freeman* were nominated as delegates and *Ed Bruck*, *Abraham Max*, and *Walter Gullison* were nominated as alternates. Since it is important to know and take part in the interim-meeting, *Les Reynold* made a motion that this branch pay the necessary expenses of one of the delegates to the interim meeting at Pittsburgh.

Application for membership was presented and accepted for *Jarratt E. Schoonmaker*, 3501 N. Lesley, who is employed by Western Electric.

Loren Stevens introduced *Norman House* who is connected with Lasalco, as the principle speaker of the evening. Mr. House gave a very good talk on the practical aspects of barrel plating. He also presented a short film to illustrate the proper load to place in a barrel and what happens when it is underloaded or overloaded with different shaped pieces.

The meeting adjourned at 9:35 P.M.

Paul B. Freeman
Secretary

Pittsburgh Branch

The November meeting of the Pittsburgh Branch was held on the 7th at the Gateway Plaza in Pittsburgh's Golden Triangle. Dinner was attended by thirty members and guests. The business meeting was opened by First Vice-President *Herb Schram* in the absence of President *Myron Ceresa*, who is recuperating from a recent operation. Two applications for membership were presented to the Branch. They were for *Bruce W. Wilson* of Pennsalt and *Guy M. Lester* of We-Sa Mfg. Co. A rising vote of congratulations was given *Frank Keller* who was elected to honorary membership in the Branch last month.

Chairman of the forthcoming Interim Meeting being held in January, *Jack Coros*, presented a report on the progress of his committee. The Penn-Sheraton Hotel has been selected as headquarters for the meeting and Chairman of Housing, *Rex Goldbach* has arranged for rooms at the Pittsburgher and Roosevelt Hotels for the delegates attending. Due to a glass convention in Pittsburgh at that time, it was not possible to obtain housing in one hotel.

Other committee chairmen were announced by Mr. Coros. They were as follows: Equipment and Notices—*J. R. Crain;* Registration of Delegates — *E. J. Smith;* Luncheon — *R. A. Woofter;* and Cocktail Party — *R. M. Burford.*

A report on the proposed Ladies Auxiliary was presented by *Scott McCormick* in the absence of Chairman *Bob Burford*. The February meeting is the probable night which the Branch members will be asked to bring their wives or girl friends to dinner. Some form of entertainment will be furnished while the business meeting is being held. It is hoped that the women will be able to get better acquainted and

possibly organize themselves for future meetings.

The guest speaker of the evening was then introduced by Librarian *Dick Woehrle*. *G. A. Lux* of Oakite Products was that speaker and the subject of his paper was "Some Fundamentals of Electrocleaning" which was extremely interesting. Dr. Lux listed the requirements essential for a good electrocleaner and explained each in detail with some interesting demonstrations.

After a short break the drawing for the door prize was held and *Dave Porter* was the winner of an electric fry pan. The prize was donated by *Bill Pizoli* of Oakite.

The meeting was adjourned after an informative question and answer period on cleaning problems.

Fred Stevens
Secretary

Central Michigan Branch

The Central Michigan Branch held its second dinner-program meeting of the year on November 13 at Hotel Hayes in Jackson, with President *G. S. Woodruff* presiding.

Lee Vorce of the Behr-Manning Co., talked on "Mechanical Polishing with Coated Abrasives." A color-sound movie illustrated many of the applications in this field. The presentation was followed by a discussion period and a social hour.

Earl D. Creese
Publicity Secretary

Los Angeles Branch

Application of ion exchange systems in the plating industry was discussed before 100 members and guests of Los Angeles Branch on the night of November 14 by *Kenneth C. Johnson*, Southern California sales engineer for the Industrial Filter & Pump Mfg. Co. of Chicago, Ill.

After presenting a brief history of the background and development of ion exchange, Johnson elaborated on raw water and recirculatory rinses for use in the plating room.

Branch president *L. Truman Stoner* presided at the induction of five new members and referred the applications of nine others to the board of managers for processing. . . Librarian *Emmet H. Babcock* reported that definite arrangements had been concluded for *Dr. Walter Meyer* of Enthone, Inc., New Haven, Conn., to head the program of technical speakers which will address the Branch's annual educational session at the Ambassador Hotel on March 23, 1957. . . Two other prominent speakers on pertinent subjects will round out a technical session scheduled from 9 a.m. to 1 p.m.

Among the guests was *Eric Blount* of Cincinnati, O., editor of *Products Finishing*, and co-chairman of the 1958 Cincinnati A.E.S. convention committee. Mr. Blount presented an invitation from Cincinnati Branch to Los Angeles members to attend the convention in the Ohio city in May, 1958.

Also introduced was *James Poulson*, formerly a sales engineer in the Los Angeles area for Wyandotte Chemicals Co., now affiliated with Coral Chemical Co. of Waukegan, Ill. Mr. Poulson holds a membership-at-large in the A.E.S.

Los Angeles Branch has arranged for two special meetings during the next two months. The December 14 meeting has been designated as Ladies Night at which the regular business and technical matters will be sidetracked in favor of a program designed to interest the distaff side. The feature of the program will be a fashion show which will be presented following the conclusion of dinner.

January 9 will be Sustaining Members Night honoring the firms who are supporting the national research program by financing a sustaining membership in Los Angeles Branch. In addition to company personnel holding membership of the branch, owners and officers of sustaining member firms are to be invited. A paper will be presented on the aspects and progress being made in A.E.S. research.

The local and out-of-town guests introduced by Sergeant-at-arms *Larry Henderson*, included the following: Mr. Poulsen, Mr. Blount, *David I. Wasity* of Axelson Mfg. Co.; *Milton Horowitz* of Jax Products; *James August*, Promat, Div., Poor & Co.; a member-at-large; *Horace Zaborn*, Bumper & Auto Processing Co.; *Jack Stone*, Millhorn Chemical Co.; *Russill Davis*, Hanson-Van Winkle-Munning Co.; *Vernon Henders*, *Nathan Robinson* and *Pater LaBarba*, Price-Pfister Co.; *H. C. Walters*, California Rack Co.; *George Peters* and *Sam Sprig*, Kelite, Inc.; *John Phelan*, H. E. Dyer, Inc.; and *Richard Zarp*, Alert Supply Co.

Baltimore-Washington Branch

The November meeting of the Baltimore-Washington Branch was held in the Chemistry Lecture Room in the Chemistry Building at the National Bureau of Standards, Washington, D. C.,

with president *Horelick* presiding. After a very short order of business, he introduced the speaker of the evening, *J. K. McLaughlin* of whose subject was "New Applications and Design in the Field of Coated Abrasives," with a general introduction and a brief history of the field of coated abrasives.

Chicago Branch

The regular meeting of the Chicago Branch was held on November 9, at the Western Society of Engineers, 84 East Randolph St. A warm welcome was extended to six guests from the Rockford Branch.

An interesting question and answer period on the subject of precious metals was held, the questions being answered by a board of experts consisting of *Joe Niles* of the George A. Stutz Mfg. Co., and *Al. Weisberg* of Technic, Inc.

The speaker of the evening was *J. E. Fritts*, director of process development, Ternstedt Division of General Motors.

Before getting into the topic of the evening, polishing and buffing research at General Motors, Mr. Fritts reported on the progress of the work on Project No. 15 (accelerated corrosion tests for the performance of plated coatings). He pointed out that Test No. 20 consisting of the use of Corrodkote and exposure in a humidity cabinet at 100°F. looked very promising.

Mr. Fritts pointed out that instruments for testing mechanical assemblies are many but that those for testing plating are few. He described a group of instruments that have been designed at General Motors and are being used to evaluate buffing compounds, buffs, and to control polishing and buffing operations.

After a lively question and answer period, Mr. Fritts was given a rising vote of thanks.

J. C. Corre
Publicity Chairman

Detroit Branch

The November meeting was opened at 8 p.m. by President *Howard Mac Aleer*, in the English Room of the Sheriton Cadillac Hotel. Mr. Mac Aleer welcomed members of the Plater's Institute as this was a joint meeting and one of the largest meetings to date, with 180 in attendance.

Secretary *Bob Racine* introduced the six new members to the group. Bob also read a letter from the editor of *Plating* magazine inviting all authors to submit technical and scientific papers. The papers must be original, unpublished works. Four typed copies are requested. *Fred Brune* reported the plating lecture series was going along in good shape with 46 registered and attending each Friday. Fred was also appointed chairman of a committee to study improvements for next year. *Herb Head* spoke about the 1959 convention to be held in Detroit. He also discussed the intrim meeting to be held in Pittsburgh and invited all to attend. Herb informed the members about Howard Mac Aleer's appointment as exposition chairman for the 1959 Convention.

Wright Wilson reported on the Annual Christmas Party to be held December 1st. To date, all the tickets have been sold and there were more requests for tickets than tickets available.

Manual Ben substituted for *Doug Thomas* and introduced the technical chairman of the evening, *Henry E. Adelsburger*, vice-president of Auto City Plating and vice-president of the Plater's Institute.

Patrick J. Driscoll

Malayan Tin Bureau

Appointment of *R. D. Coursen* as deputy director of *The Malayan Tin Bureau*, Washington, D. C., was announced recently.

Mr. Coursen, formerly vice-president of Cornwell, Inc., agricultural consultants, has joined the bureau to assist in the distribution of accurate information about tin production and marketing and to promote a better understanding between the United States, world's largest consumer of tin, and Malaya, world's largest producer.

A graduate of Yale University, Mr. Coursen was director of marketing for Northrup, King and Co., international seedsmen in Minneapolis. He moved to Washington in 1954 to participate in the reorganization of the Council for Agricultural and Chemurgic Research. Subsequently he became its director of education and editor of its magazine, "Chemurgic Digest."

At Cornwell, Inc., Mr. Coursen was co-publisher of the "Conservation Yearbook," an almanac of conservation of our renewable natural resources.

Task Committee on Industrial Wastes

The 1956 meeting of the National Technical Task Committee on Industrial Wastes will meet at the Mellon Institute in Pittsburgh, December 13 and 14. This Committee includes one

delegate and an alternate from every industry that has waste disposal problems. *Prof. C. Fred Gurnham*, head of the Department of Chemical Engineering at Michigan State University, and delegate from the electroplating industry, will preside at the meeting as 1956 Chairman of NTTCIW. *Dr. D. Gardner Foulke*, of Hanson-Van Winkle-Munning Co., alternate delegate, will present the report of progress for the industry. The two-day meeting will emphasize research activities and research needs, based on report of subcommittees and studies by the U. S. Public Health Service.

OBITUARY

J. J. HANNEY

J. J. Hanney, 58, of Grand Rapids, Mich., sales representative of *Metal & Thermit Corp.*, died of a heart attack on November 24 while on a hunting trip.

J. J. Hanney

Well known in the electroplating industry "Jack" Hanney joined *United Chromium, Inc.*, a former subsidiary of Metal & Thermit, in 1944. Throughout his career he was active in the American Electroplaters' Society, having served on various committees. He was also a past president of its Grand Rapids branch. At M&T he earned a number of awards for outstanding salesmanship and took particular interest in training and developing junior salesmen.

He is survived by his wife, a daughter and five grandchildren.

News from California

By Fred A. Herr

The DeVilbiss Co. of Toledo, O., manufacturers of spray equipment, has completed a new $600-000 warehousing, sales and service plant in Los Angeles and expected to be moved in by January 15. The new plant, at East Slauson and Garfield Aves., in the East Side manufacturing district, contains approximately 25,000 sq. ft. of floor area and provides the firm with four times the space available at its former Los Angeles branch at 420 S. Los Angeles St.

Branch manager *George Fulton* reported to METAL FINISHING that the new plant will be devoted to warehousing, sales, engineering and rebuilding of the company's equipment. It also includes a customer service laboratory. The firm also maintains a large plant in Santa Clara, Calif., for service to clients in the San Francisco Bay area.

Henry M. Kidd, of Toledo, vice-president in charge of spray equipment sales, was in Los Angeles in November to inspect the progress of the new plant and to attend a convention of the paint and varnish industry at the Statler Hotel in Los Angeles.

Executives of the Rheem Automotive Company served as hosts at a press reception on December 11 at which representatives of the newspaper and technical trade press were given a preview of the facilities of the company's new multi million dollar plant in Fullerton, Calif., in advance of the formal dedication on December 12.

Frank S. Fisher, vice-president and general manager, *O. W. Carrico*, vice-president of manufacturing, and *A. N. Coleman*, industrial relations manager, served as guides on a tour of the plant. The visitors were shown through the various production and processing departments, from the department at which panels of hot rolled, low alloy, high tensile steel arrives, through the pickling, roller, and flat bed polishing section, and into the huge plating department.

Company officials refer to their new metal finishing department as " . . . the largest and most efficient plating line west of the Mississippi River."

The new facility was designed to give completely automatic cleaning, pickling, nickel strike, and pre-plate operations combined with mono-tractor fed, cell-type nickel and chromium plating tanks. The machine is 133′ long, 15′ wide and 22′ high, and is operated by hydraulic power units. Ten to 16 bumpers are placed on each plating rack in a floor-level racking area and are then delivered automatically to the machine by a monorail system.

The nickel line consists of two sections each composed of 16 tanks of 3,750 gallons capacity each. Each tank is powered by a 5,000 ampere, 18 volt germanium rectifier. The chromium plating facilities consist of two 3,750 gallon tanks, each of which is powered by a 20,000 ampere, 15 volt germanium rectifier.

Work carriers and plating racks are processed by the monorail system through an electrolytic rack stripping tank containing 3,100 gallons of solution. The solutions in the plating department are heated by steam from two cross-drum type boilers of 500 H.P. capacity.

Sponsored by the Los Angeles Chamber of Commerce in co-operation with the Small Business Administration, a small business procurement conference was held at the Hollywood Palladium recently. First of its type to be held in Los Angeles, the conference was attended by more than 1,000 local business leaders and government officials.

Spotlighting the role of small business in the government procurement program, the day-long meeting was

designed to provide small manufacturers with a better understanding of how to obtain government prime and subcontracts. Members of the plating, anodizing, and general finishing field in Southern California were well represented at the session.

The principal speaker was *Arthur S. Flemming*, director, Office of Defense Mobilization, Washington, D. C. Other speakers included *Thomas Wolfe*, director for Requirements, Procurement and Distribution, office of the Assistant Secretary of Defense; *Col. Robert Kirkland*, chief of the Los Angeles Air Procurement District; and *Capt. William M. Lands*, commanding officer, Navy Purchasing Office, 11th Naval District. Eight branches of the government conducted panel discussions during the program.

Kaiser Aluminum & Chemical Sales, Inc., of Oakland, Calif., has opened a new branch office in Phoenix, Ariz., headed by *R. D., Loeffler* as branch manager. The new office at 213 N. First Ave. was set up, it was announced, to meet the growing demand for aluminum products by Arizona manufacturers. Loeffler was formerly attached to the firm's aluminum sales staff in Los Angeles.

In order to acquaint Southern California platers with the vigorous policy of enforcement which the U. S. Department of Commerce and the Department of Justice are invoking against violators of the Defense Production Act, *Edwin Bates*, field office manager for the Commerce Department in Los Angeles, has given wide circulation in that area to the prosecutions pending against recent violators in the mid-West.

Bates requested officers of Los Angeles Branch, A.E.S. to acquaint their members with the gravity involved in such violations. He pointed out that a 10-count criminal information was recently filed against a Chicago manufacturer for illegal use of defense priority ratings to obtain 44,000 pounds of nickel anodes and salts.

The information was filed against *Bernard Schwartz* and Consolidated Metal Mfg., Inc., of Chicago. The charges involve the alleged illegal acquisition of 24,000 pounds of single nickel salts and 20,000 pounds of nickel anodes in the period March 1, 1954, to June 21, 1955. Each count of the information, Bates pointed out, carries a maximum penalty of one year's imprisonment or a fine of $10,000, or both.

Bates declared that demand for nickel consistently has exceeded available supplies in recent years, creating a situation that has led to a number of reported violations in the use of defense priorities to obtain the metal. A number of other cases are now under investigation, according to Bates, and prosecution will be recommended to the Department of Justice in all cases where such action is justified.

William H. Eisenman of Cleveland, O., national secretary of the American Society for Metals, was in Los Angeles in late November to confer with local committeemen on arrangements for the 10th Western Metal Exposition to be held March 25 to 29 in Los Angeles.

Eisenman met with ASM program committeemen headed by *William V. Ward* of the Lockheed Aircraft Corp., Burbank, Calif. Other committeemen in attendance at two conferences with Eisenman and *Dr. Donald S. Clark* of the California Institute of Technology, Pasadena, Calif., who is national president of the ASM, included the following: *James R. Cody*, associate professor at the University of Southern California; *C. D. D'Amico*, sales manager, James T. Ryerson & Son, Los Angeles; *Jonmore Dickason*, general manager, Metal Control Laboratories, Los Angeles; and *John E. Wilson*, district manager, Climax Molybdenum Co. Einseman also conferred with *Charles W. Concannon*, program director of the American Welding Society, one of the sponsoring groups for the Western Metal Congress.

NEW BOOKS

Bibliographical Abstracts of Methods for Analysis of Synthetic Detergents

Published by American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa., 1956. Price: $1.50. 44 pages, paper cover.

This booklet has been prepared to fill the need arising from the increasing interest in analysis of synthetic detergents. It brings up to date and supersedes the 1953 edition with 311 abstracts as compared to the 96 in the previous edition. As far as possible the original references have been abstracted with the peculiar needs of analysts in mind. Where original references were unavailable, abstract journals were used, and these are given in such cases as secondary references. The first reference is dated 1888, much in advance of today's detergents, but it is significant as the basis for techniques which may currently be used.

References and abstracts are arranged chronologically from 1888 through 1955 with seven 1956 items listed. There are complete subject and author indexes.

The book was prepared by Jay C. Harris and Ruben Bernstein for Subcommittee T-2 of ASTM Committee D-12 on Soaps and Other Detergents.

Nickel Handbook and Commercial Outlook for 1957

Published by Herman B., Director Associates, 1511 K Street, N. W., Washington 5, D. C. 1956. Price: $10.00. 70 pages. Paper cover.

This compilation consists of a detailed description of the supply-demand outlook for 1957, as well as information concerning production, consumption, prices, primary nickel producers, nickel plating supply houses, jobbers and secondary nickel suppliers. There appears to be little in this small book of value to the nickel plater to warrant the rather high price. The list of suppliers can be found in the METAL FINISHING GUIDEBOOK-DIRECTORY, and the other data have appeared from time to time in a number of trade papers which those interested in such figures would ordinarily read. Of value, however, is the last section which describes government activities and reproduces BDSA regulations affecting nickel.

Chemical Engineering Catalog

Published by Reinhold Pub. Corp., 430 Park Ave., New York 22, N. Y. 1956-7. 1,932 pages.

The forty-first edition of this standard reference source for users of engineering materials and equipment lists the products of more than 550 manufacturers. The volume is indexed by companies, functional titles, equipment, plant construction services, pilot plant services, and trade names. This variety of index categories simplifies the task of equipment users in searching for a particular product or manufacturer.

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M-G SETS — Motor 3-60-220/440

Amp.	Volt	Make
100	7½	Hobart
175	14	Delco
200	7½	Chandeysson
300	7½	Hobart
400	60/60	G. E.
500	6	Chandeysson
500/250	6/12	Elec. Prod.
750/375	6/12	Excel
940	32	Elec. Prod.
1500	15	Star
1500	30/50	Century
1500	40/65	G. E.
1500	65	Westinghouse
1500	70	Century
2500/1250	6/12	Elec. Prod.
5000/2500	6/12	Columbia
5000/2500	9/18	Chandeysson
15000/7500	12/24	Elec. Prod.

BLOWERS & EXHAUSTERS

CFM	Pres.	Make
1100	4½" S.P.	Bayley
2344	2" S.P.	Clarage
2500	½" S.P.	American
2700	⅝" S.P.	Ilg
3420	8" S.P.	New York
9000	6" S.P.	Northern

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Slightly Used
BUFFS

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Loose and Sewed

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Any Quantity

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DETROIT 12, MICHIGAN

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Complete barrel plating line for sale. Acquisition cost $31,801.00. Will sell as is for $11,000.00. 4 rinse tank assemblies, 2 pickle tank assemblies, refrigeration unit, #2 crown dryer, rectifier, demagnetizing unit, 2 acid vats, 1 dummy, mueller boiler and condensate return, monorail, motor lifts, 3 rectoplaters, barrels and all accessories. Write Box 1021, Lufkin, Texas.

AVAILABLE FOR
IMMEDIATE SHIPMENT, ATTRACTIVE VALUES

THE FOLLOWING EXCELLENT REBUILT AND GUARANTEED ELECTROPLATING MOTOR GENERATOR SETS AND RECTIFIERS, WITH FULL CONTROL EQUIPMENT:

— PLATERS —

4—12500/6250 Ampere, 6/12 Volt, Electric Products, Synch.
1—10,000/5000 Ampere, 6/12 Volt, Chandeysson, Synch., Exc.-in-head.
1—8000/4000 Ampere, 6/12 Volt, Chandeysson, Synch.
1—7500/3750 Ampere, 9/18 Volt, Hanson-Van Winkle-Munning, Synch.
1—6000/3000 Ampere, 6/12 Volt, Electric Products, Synch.
1—5000/2500 Ampere, 9/18 Volt, Chandeysson, Synch., Exc.-in-head.
4—3000/1500 Ampere, 12/24 Volt, Chandeysson, Exciter-in-head.
1—2500/1250 Ampere, 9/18 Volt, Electric Products, Synch., Exc.-in-head. 25°C.
1—2000/1000 Ampere, 6/12 volt, Hanson-Van Winkle-Munning.
1—2000/1000 Ampere, 9/18 Volt, Electric Products.
1—1500/750 Ampere, 12/24 volt, Chandeysson, Synch., Exc.-in-head.

— ANODIZERS —

1—1000 Ampere, 40 Volt, Chandeysson, 25° C.
1—1000 Amp., 30 V., Ideal, Exc.-in-head.
1—750 Ampere, 60 Volt, Hanson-Van Winkle-Munning, Synch., Exc.-in-head.
1—500 Ampere, 25 Volt, Chandeysson, Synch., Exc.-in-head.
4—400 Ampere, 40 Volt, Separately Excited.

— RECTIFIERS —

1—2000/1000 Ampere, 6/12 Volt, G. E.
1—Green Selectoplater, 1800 Ampere, 12 Volt, 220/3/60.
1—1500/750 Ampere, 6/12 Volt, Udylite-Mallory.
4—1440/720 Ampere, 6/12 Volt, Udylite-Mallory.
1—750 Ampere, 12 Volt Self-Contained Selenium Udylite-Mallory.

— SPECIAL —

Crown & H-VW-M Centrifugal Dryers, #1 and #2, with heat.
1—H-VW-M Full-Automatic Plating Machine, 87' long, 39" lift, was used for chrome.
1—Udylite Semi-Automatic Plating Machine, for cyanide, size 19' long x 48" wide x 36" deep.
2—RONCI Enamelers, No. R-100 and R-200.
1—Almco DB-8 Deburring Barrel, 2-Compartment, Vari-Drive.

Above is partial list only. Write to us for all your requirements for Plating, Anodizing and Metal Finishing.

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WINTER SPECIALS - PRICED RIGHT!

1—Daniels #40LS Koroseal Lined Plating Barrel.

1—Alsop Stainless Steel Filter and Pump 300 G.P.H. cyanide or acid solutions.

2—Abbott Horizontal Wood Lined Tumblers 30"-36" diameter x 12"-18" wide motor driven.

2—Belke Tilting and Horizontal Tumblers wood lined, motor driven.

10—Variable Speed Polishing Machines, Hammond, Divine, Gardner, U. S. Electric, L'Hommedieu, etc. 3 HP to 15 HP.

4—Double Polishing Machines (2 motors) 5 HP, 7½ HP, 10 HP, 15 HP.

2—New Crown Plating Barrels, bakelite cylinders, standard perforations with gears and superstructure.

1—Crown Centrifugal Dryer with steam heat attachment.

8—Rectifiers 250 Amp, 300 Amp, 500 Amp, 1000 Amp. 6 to 12 D.C. volts.

1—Semi Automatic Polishing attachment 4 spindle indexing type motor driven.

1—Chandeysson Synchronous Motor Generator Set 6000/3000 amperes 6/12 D.C. volts.

1—Duriron Heat Exchanger with pump and motor.

4—Periodic Reverse Units 100 to 500 ampere capacity.

1—Blakeslee Automatic small parts Dryer.

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SPECIAL—Chandeysson Motor Generator Set, 6000/3000 Amp. 6/12 volt, 300 R.P.M. — Complete — Cheap.

AUTOMATIC POLISHING EQUIPMENT
2—L-8-L Acme Fully Automatic Polishing Machines, 8 spindles, each machine with 3, 2 H.P. Polishing Heads.
2—Acme A-2.
2—Acme E-10 with A-2 Heads
2—Acme E-10 with 45° Angle flat attachment.
1—Packermatic 60" Table with 12" centers & 7 polishing heads.
7—3 to 10 H.P. heads for Automatic Buffing Machines.
21—Automatic Machine Co. Oscillating single spindle, semi-automatics, Lefts & Rights.
1—8-Spindle Semi-Automatic Buffing Machine.

POLISHING MACHINES
3—#95 U.S. Variable Speed Polishing Mach. 5 H.P.
1—5 H.P. Divine Pol. Mach., also 7½ & 10 H.P.
1—Hisey-Wolf 5 H.P. Var. Speed pol. mach.
Send for complete listing of polishing machines available. New 5 H.P. Lathes $385.00. New 7½ H.P. Lathes $445.00.

TUBE POLISHING EQUIPMENT
2—Production Tube Polishing #101, up to 6" tubing.
1—Type "S" Production Tube Polisher, up to 1¼" tubing.
1—Type "A" Production Tube Polisher, up to 6" tubing.

FILTERS
1—Industrial RDR-2 36-3630 complete with motor, slurry tank, and primer excellent condition.
5—Industrial Filters Rubber Lined 10 x 28, 14" x 36" 10 x 22.
4—Alsop NR & WR 5", 7" & 11" disc stainless steel.
21—Stainless steel and plain steel various makes.

PLATING BARRELS
2—LaSalco 14" x 42".
3—Mercil 14" x 30" Rubber Lined Plating Barrels.
1—Double 14" x 30" Udylite.
1—Daniels #4.
1—Daniels #8.
1—Stevens 6 barrel 20' horseshoe type Semi-Automatic w/6 extra barrels.

TUMBLING EQUIPMENT
2—New LaSalco Tilting Type.
2—Almco 32" x 32".
1—Roto-Finish DW 30-36-1 steel complete.
2—Henderson #5 & 5A.
10—Abbotts 8" x 30", 16" x 30" single and double comp. belt and motor driven.

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Plating, Polishing, Grinding, Spraying, Baking, Drying, Tumbling, Cleaning, Degreasing & Anodizing Equipment. Anodes, Chemicals, Acids, Cyanides, Solvents, Supplies for Wood, Plastics and Metals.

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1—3000 Amp., 18 Volt Hanson-Van Winkle
1—3000 Amp., 6 Volt Bart-Messing
1—2000 Amp., 6 Volt Hanson-Van Winkle
2—1500 Amp., 6 Volt Richardson-Allen
1—1000 Amp., 6 Volt Hanson-Van Winkle

MOTOR GENERATOR SETS
1—2500/1250 Amp. H-V-W, 6/12 volts
1—3200 Amp. General Electric, 24 volt
1—1600 Amp. General Electric, 24 volt
1—1000 Amp. Century, 24 volt
1—750 Amp. Westinghouse, 24 volt

HEAT EXCHANGERS
2—Industrial 12 Graphite Tubes, 6400 gallon heating, 320,000 BTU cooling
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PUMPS
10—Sump Pumps 1 HP to 7½ HP
15—LaBour, Industrial, lead lined, stainless steel and Duriron Centrifugal Pumps

EXHAUST FANS
10—Buffalo size 450C, 450D, 400D and 375C vent sets

MOTORS
10—½ & 1 HP Boston ratio motors for oscillation motions
4—2 & 3 HP geared head agitators

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One Hammond Model 2710 FC over and under straight line conveyor including: five Hammond model 50-99 full floating head and stand units; 16 inch maximum diameter buffs, 7½ H.P. motors, 440V; 3 ph.; 60 CPS. Gravity return conveyor; one set fixture carriages equipped with both Hammond auto dopers and liquid compound system. Complete dust collecting system including duct work, fan and collector.

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GENERATORS

IN STOCK

*2500 amp. 6 volt Chandy. synch. 25° C. Used.

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*4000 amp. 12 volt Chandy. synch. 25° C. Used.

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*1000 amp. 6 volt Elec. Prod. synch. 40° C. New.

*All double commutator units include DC panel and starter.

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Welding & tank Co., west central Florida. Volume $76,750. Forty year landmark. Mfgr. tanks, stacks, breechings, pipes, etc. Located in prosperous industrial & trading city. One city block with 13 buildings comprises property. Low price. Illness — tremendous potential. Address: Dept. 8148.

Iron works, southeast Georgia. Top profits. Ideal location, large building and land tract. RR spur, parking facilities, all equipment. Retiring. Underpriced. A-1 business opportunity. Investigate. Address: Dept. 8196-A.

Metal plating, central Georgia. Silver and chrome. No competition! Ideal location, excellent profit opportunity. Tops for expansion. Address: Dept. 8282.

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Udylite semi-automatic plating tanks 11'6" x 44" x 36".

1—Unlined for copper plating.

1—Koroseal lined for nickel plating. Also, chrome plating tank.

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Can be inspected in operating condition.

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JOMA MFG. CO., INC.
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FOREMAN PLATER

SITUATION WANTED — Ten years progressive, varied experience in job shop plating, which includes make-up, working and maintaining most all solutions, barrel and still tanks. Black oxide coatings, phosphating, anodizing. Able to organize and control plating departments. Plating all difficult jobs is my specialty. Honest, conscientious and progressive. Salary commensurate with proven ability. Address: January 4, care Metal Finishing, 381 Broadway, Westwood, N. J.

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SITUATIONS OPEN—If you have been wanting to get into or better your position in the management and promotion of metal finishing cleaner sales with a sizeable company of excellent reputation on a national market basis, this might be your opportunity. Excellent existing line of cleaners and trade relations. Location, midwest, but will move good man from other location. Compensation and opportunity attractive. Write stating experience, qualifications and compensation desired. Address: January 1, care Metal Finishing, 381 Broadway, Westwood, N. J.

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SITUATIONS OPEN — Leading national manufacturer of industrial detergents has opening in Los Angeles and other areas for qualified men. Degree in chemical engineering or chemistry preferred. Candidates with backgrounds in metal cleaning and finishing desired, although experience in related fields would be acceptable. Candidates should have sales management experience or potential in that direction. Age to 45. Salary open. Send confidential resume to:

HERGENRATHER ASSOCIATES
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BUFFING COMPOUND SALESMEN

SITUATION OPEN — Distributors, jobbers and manufacturers agents wanted to distribute and sell the full line of Schaffner's polishing and buffing composition in bar, spray or paste form, and a complete line of polishing room supplies.

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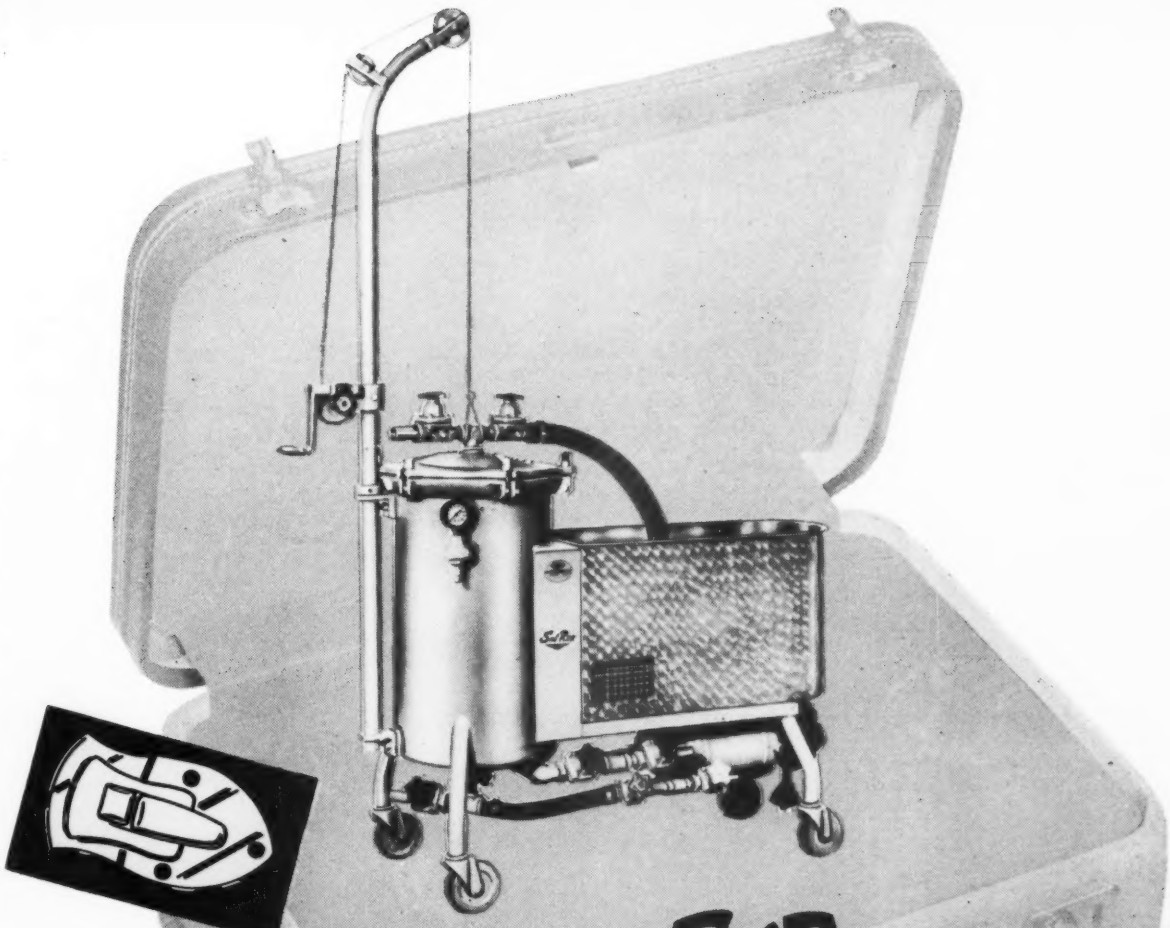

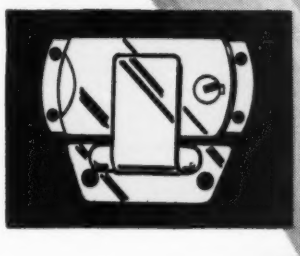

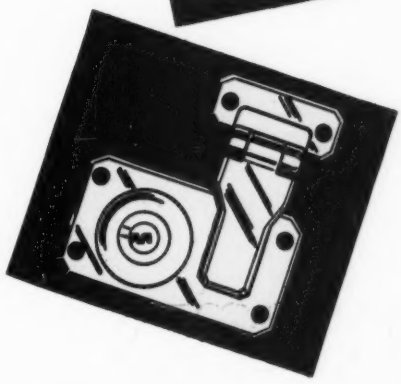

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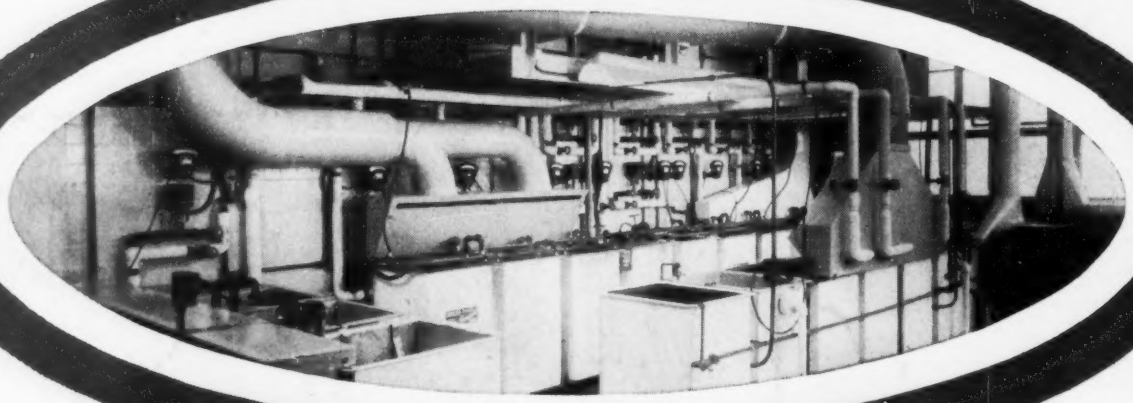

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